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New Zealand Geographer

VOLUME XVII *April, 1961* *NUMBER 1*

PIONEERING THE BUSHLAND OF LOWLAND TARANAKI: A CASE STUDY

W. B. JOHNSTON

THE TRANSFORMATION of forest to grassland is an important and well-recognised theme in the settlement of New Zealand and especially of the North Island. The process of clearing the bush and developing farmland has been frequently described by contemporary writers of the period as well as in historical writings of the era and in geographical works of the area.[1] G. C. Petersen has given a useful account of the pace of clearing in most areas of the North Island covered in bush at the time of European settlement;[2] A. C. Burgess[3] has recently described the physical patterns of Taranaki and, using contemporary writers in the *New Zealand Country Journal* and the *New Zealand Farmer*, and Philpott's standard history of dairy farming,[4] has given a general picture of the development of farmland from bush. However, the documentation of the transformation of forest to grassland is by no means complete. As G. Jobberns and Petersen have both pointed out,[5] there is a notable lack of personal records left by the bush settlers who were generally too preoccupied with the problem of existence to have leisure to produce diaries at all comparable with those, for instance, of the large runholders of Canterbury.

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[1] See for example G. C. Petersen: *Forest Homes*, Wellington, 1956; P. Kennaway: *Pioneering in Poverty Bay*, London, 1928; T. Kelly: 'Bush Burn Farming in Taranaki, 1877', *N.Z. Country Journal*, Vol. 1, 1877, pp. 242–245, (reprinted in *Lincoln College Rural Education Bull.*, Vol. 5, 1950, pp. 147–150.)

[2] G. C. Petersen: 'Pioneering the New Zealand Bush', *N.Z. Geographical Society Record*, No. 27, 1959, pp. 5–8.

[3] A. C. Burgess: 'Farming in New Zealand: Taranaki', *N.Z. Journ. Agric.*, Vol. 96, 1958, pp. 369–386, 454–465, 531–536. See also P. R. Stephens: 'Farming 50 Years Ago', *ibid.*, Vol. 100, 1960, especially pp. 521–526 on the bush-burn technique.

[4] H. G. Philpott: *A History of the New Zealand Dairy Industry*, Wellington, 1938.

[5] G. Jobberns: 'Life and Landscape in New Zealand—Fifty Years in Retrospect', *New Zealand: Inventory and Prospect*, Wellington Branch, N.Z. Geographical Society, 1956, pp. 2–3; Petersen: 'Pioneering the New Zealand Bush', *op. cit.* p. 5.

This paper is a contribution towards the filling of this gap. It is based on an analysis of the diaries of one of those who took up some of the bush land in Taranaki and found time to record, in considerable detail, the daily activities of the family members.[6] The farm, which is still owned by the descendants of the pioneer, is near Huirangi, inland of Waitara, in North Taranaki. The land was originally accepted by the author of the diary and his brother-in-law in return for military service during the Maori Wars. Consisting of two 50-acre sections, the development of the farm from bush dates from 1874, and the property is now one of the prosperous and highly-productive dairy farms of the North Taranaki lowlands.

Bases of Analysis and Representation

The period covered in this paper is the first 25 years of settlement on the land; the method used is a statistical analysis of recorded activities.[7] The diaries contain sufficient detail to permit an analysis on the basis of morning and afternoon activities which were classified into one of several arbitrarily-defined categories. In some cases the placing of activities into a particular category created difficulties but it was decided to restrict the number of categories to a manageable total. It needs to be clearly understood that the diaries, although written by the same head of the family throughout the period, record the activities of all persons working and living on the farm. Different activities were sometimes performed by members of the family and, in these instances, preference was given to those concerned with farm work in order to see more clearly the process of farm development.

The categories were decided on empirically. They are ten in number. 'Domestic Activities' includes building, gardening, cutting firewood and Sunday functions such as visiting and attending church services. 'Marketing and Travelling' covers journeys to markets and sales, and holidays. An important category is 'Extra-Farm Work' which embraces contracts for ploughing, bushfelling and roadwork, and labour exchange (that is, where work for neighbouring farmers is repaid by an equal time spent by neighbours on the home farm). Time spent specifically on farm work is divided into seven categories. 'Clearing' includes scrub cutting and tree felling, burning, gathering and stumping. 'Ploughing', 'Sowing', 'Harvesting' and 'Fencing' are self-explanatory. 'Weeding and Cultivating' as one category embraces moulding potatoes, clearing weeds and spreading fertilisers. 'Animal Husbandry' includes the care of animals, churning butter and taking milk to the dairy factory.

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[6] The diaries are those of the Wells family and are in the possession of Mr R. G. Wells of Waitara, Taranaki, to whom grateful acknowledgement is made for permission to use the diaries and for assistance in other ways. The valuable help of Mr R. L. Wells, the present owner of the property, is greatly appreciated.

[7] The method used in this paper owes much to the published work of W. R. Mead and especially to his stimulating article 'The Seasonal Round. A Study of Adjustment on Finland's Pioneer Fringe', *Tijdschrift voor Economische en Sociale Geografie*, July, 1958, pp. 157-162.

The classification of information into categories is based on half-day units for the years 1876, 1882, 1889 and 1900. The number of half days in each category was totalled for each month and plotted in the form of subdivided bargraphs for the twelve months of each selected year. For each year there are three basic bargraphs. The first shows the activities collected in four groups; namely 'Domestic', 'Marketing and Travelling', 'Extra-Farm Work', and a composite 'Farm Work' group. The second bargraph for each year breaks down the composite 'Farm Work' group into the defined categories of 'Clearing', 'Fencing', 'Weeding and Cultivating', and 'Animal Husbandry', together with a composite cropping group which in the third bargraph is broken down into the defined categories of 'Ploughing', 'Sowing' and 'Harvesting'.

THE BALANCE OF ACTIVITIES

Figure 1 shows the general structure of activities for the four years. In 1876, two years after settling on the land, the small amount of time occupied by farm work is balanced by the importance of work outside the farm. In common with most bush farmers elsewhere in the North Island the early years of settlement demanded recourse to varied means of supplementing income and many winter days were spent in fulfilling road-making contracts, cutting shingles for sale, and felling bush on contract. During the summer, extra-farm work involved helping neighbours, on a labour-exchange basis, to shear wool off the few sheep kept at the time, to harvest and to plough.

By 1882 the pattern was changing. Farm work was of greater importance although work outside the farm on a contract or on a labour-exchange basis still made a heavy demand on time. During this year road construction occupied several days in December and cutting and threshing grass seed and wheat, in addition to ploughing, were major demands from neighbouring farmers. The years 1889 and 1900 show that the amount of extra-farm work declined as the demand for time on the farm grew. From April to July in 1889 a bridge and road making contract was fulfilled but by 1900 the principal extra-farm work was in helping neighbours at harvest time and attending to mechanical breakdowns at the dairy factory.

During the four years the pattern of marketing and travelling is fairly regular. Almost without fail Saturday was market day, when the journey to New Plymouth by horse and cart took place. Not only did this allow the marketing of farm produce—butter, grass seed, fungus, potatoes, eggs—and the purchase of a great variety of supplies for cash or on credit or by barter, but it also served as a means of transport for the produce and supplies of neighbouring farmers. For the four selected years the only record of any holiday away from the farm is in August of 1900 and this was for less than a week.

Throughout each year Sunday was always a day of rest from physical labour. Church was regularly attended, visits made to neighbours, and visitors received and taken around the farm. Other domestic activities such as gardening and wood cutting were common to all years. The rhythm of domestic activity was heightened in May, July and August of 1876 when a more substantial home of timber walls and shingle roof was built to replace the smaller and more frugal abode of the first two years. Again in 1900 the menfolk were busy building a large barn in March, April and May, and a community hall in later months.

Over the four years the increased importance of farm work in the balance of activities is clearly shown. This is directly related to the increasing ability of the farm to produce an income sufficient to support the family. In 1876, with development just begun, outside employment was essential to subsistence; by 1900 the farm provided a living.

CLEARING THE BUSH

The seasonal round of farm work is shown in *Figure* 2. Obviously the prime task in settling the land was to clear the bush. The tangled undergrowth was cut in late winter or early summer and allowed to dry to form a good firebed by late summer when the bush burn occurred. Burning was immediately followed by picking up the scattered remnants, and setting fire to them. The year 1876 shows this sequence but in 1882 the pattern has changed. Most of the clearing work was now involved in removing the stumps and little felling or burning remained to be done on the original holding. Between 1882 and 1889 another bush section was obtained thus accounting for the

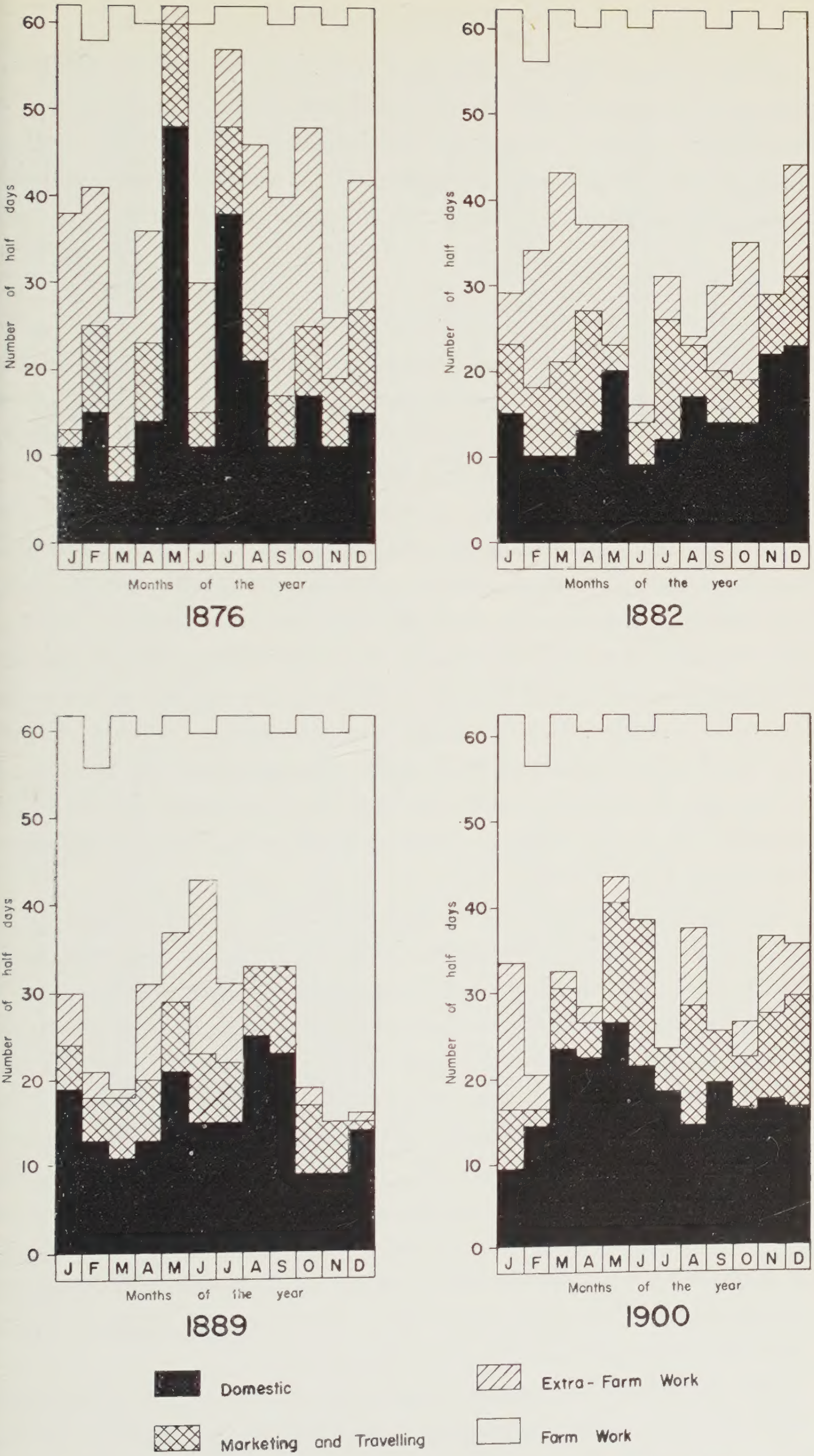

Fig. 1. The annual round of activities on a Taranaki farm for four selected years similarity of 1876 and 1889 patterns. For the latter year the burning and picking-up period of March and April was prominent, as were the bushfelling months of November and December. The winter clearing work of 1889 represents the stumping of land previously fired and this work is paralleled over a longer winter period in 1900.

Cropping the Land

'Ploughing', 'Sowing' and 'Harvesting' may be conveniently regarded as cropping the land but in order to analyse the role of each they are discussed separately (*Fig.* 3). In terms of time, ploughing was of small importance in 1876 and even in 1882, but in 1889 and 1900 it was a prominent seasonal activity. Its relative unimportance in 1876 and 1882 arises from the manner in which pastures were first established. The burnt-over areas were sown in grass seed by hand while the ashes were still warm. It was not until the land had been cleared of stumps and cropped that permanent pastures were sown down after ploughing. Ploughing, however, did feature in all the years and in each case the pattern was similar. The first distinct period was in February, March and April when stubble of grain crops was ploughed in; the second period was in August, September and October when the land was prepared for fodder crops, in particular of carrots, turnips and mangolds (*Figs.* 3 and 4).

Sowing or planting of grass seed and crops was important in all years particularly in 1889 when, in the preparation for permanent pasture and under the impetus of low butter prices, several acres were planted in potatoes and sown in wheat in addition to other crops. Overall, two distinct periods stand out (*Figs.* 3 and 4). The first was in February, March and April when grass seed was surface-sown after the firestick, and, in later years, sown after the plough. During the same period, oats and, occasionally, turnips were sown. However, the main sowing period was in August, September, October and November when potatoes were planted and some of the considerable variety of fodder crops grown in one year or another—carrots, mangolds, turnips, Indian corn, radishes, millet—were sown. In addition wheat, oats and barley were usually sown at this time.

The pattern of harvesting from year to year varied significantly with the changes in cropping practices (*Fig.* 3). In general there was an increase in the time spent in harvesting during the middle years when

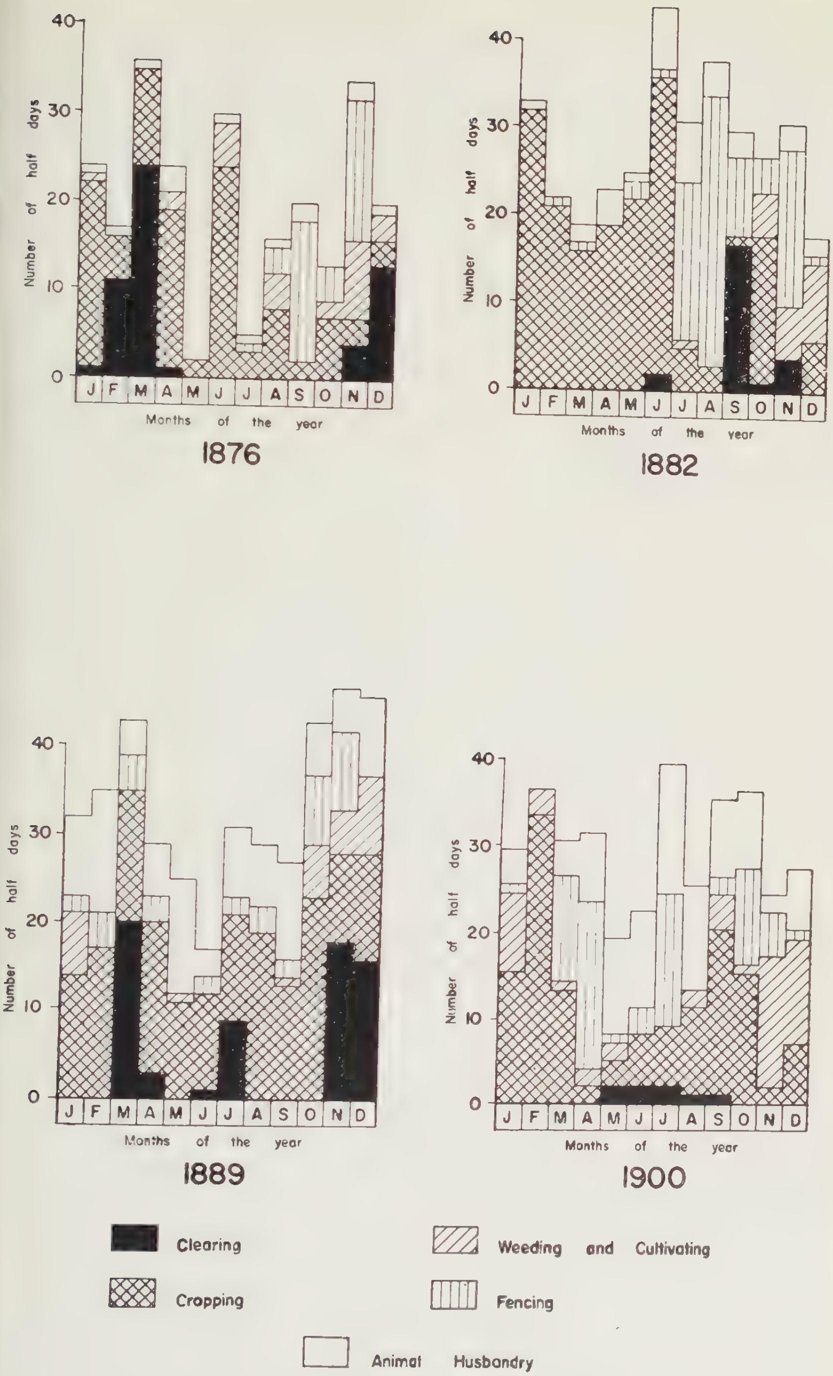

Fig. 2. The annual round of farm work for four selected years cash crops such as wheat and grass seed were important and when potatoes occupied several acres each year. Cropping was most important in the farming system during 1882 and 1889. Three main harvesting periods are present through the years (*Fig.* 4). The first was in January, February and March when grass, particularly cocksfoot, was cut and threshed for seed, together with oats in 1876 and oats, wheat and barley in later years. The second period covered April, May, June, July and August when potatoes were harvested as the sole crop in 1876 and with a variety of root crops in later years. The third period, December overlapping into January, was present from 1882 when the making of hay first appeared.

Changing Crop Associations

The particular association of crops varied from year to year. In 1876 oats, potatoes and grass seed featured; by 1882 wheat, barley and hay had been added; in 1889 barley was absent but carrots, turnips and mangolds were prominent; and by 1900 potatoes were less significant, barley had replaced wheat, and carrots and turnips had increased in importance. The changes in crop associations show the developing farm practice. Over the 25 years the common sequence was to fell the bush, burn, surface-sow grasses, cut and thresh grass seed for sale or for resowing, take a crop of wheat or barley, stump, plough, crop potatoes or carrots or turnips and grain, plough and finally sow down in long-term pasture. By 1900 the early temporary pasture association of cocksfoot and ryegrass was improved by the addition of timothy, cowgrass and clover, a seed mixture which in that year was sown down with various fertilisers, particularly bone dust and basic slag. Only in 1900 is the use of any fertiliser recorded in the diaries of the four years, and by that time the farm was well on the way towards a grassland-farming economy. Problems of increasing importance in later years are indicated by the greater amount of time devoted to weeding (*Fig.* 2); in 1900 several days were spent in grubbing blackberries which spread rapidly as the enhanced fertility from the bush burn was taken out of the ground.

The total time devoted to 'Ploughing', 'Sowing' and 'Harvesting' shows considerable variation from year to year (*Fig.* 3). From some fifty-four days in 1876, the total rose to eighty-nine days in 1882, decreasing to eighty-three days in 1889 and sixty-seven days in 1900.

The peak in the middle years reflects the important and lengthy harvesting periods of grass seed in 1882, and the sowing and harvesting periods of fodder and grain crops in 1889. The passing of the cropping era results in the overall decline in time in 1900. Along with the changes in total time occupied in these activities, there was a seasonal adjustment. Whereas in 1876 and 1882 the first six months of the year is a busy period, by 1889 the seasonal spread is remarkably uniform. For 1900 the seasonal rhythm is distinctly concentrated into late summer

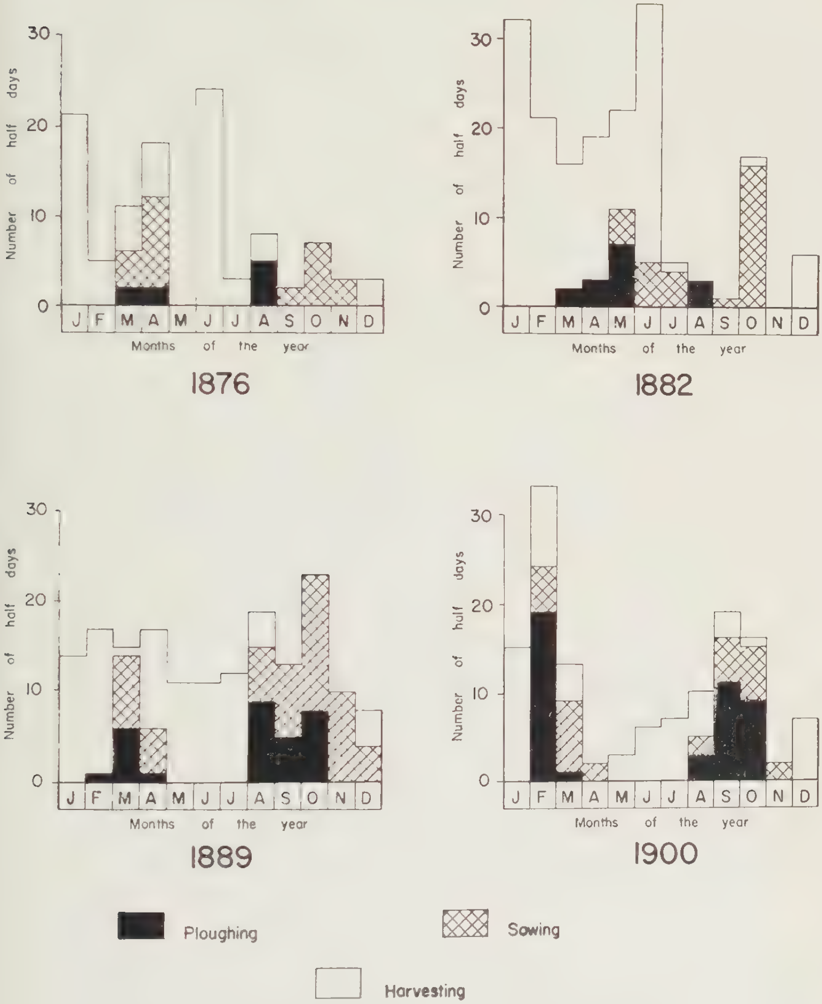

Fig. 3. The annual round of cropping for four selected years and spring, a product of the decline in fodder and grain cropping and the developing grassland economy.

FENCING

Fences not only keep animals in but also keep them out, and the prime function of fences changed as the land was cleared of bush and dairy cows came to take pride of place in the farming economy. In the early years the role of fences was to keep animals out, to keep cows and horses off the valuable patches of oats, young grass and potatoes. Apart from these clearings, the animals were free to roam widely over neighbouring land and often they got themselves lost in the surrounding bush. Angry neighbours came to insist that farmers either erect fences to keep their livestock in or pay for the damage caused to crops. For this reason, as much as for any other, farm boundary fences were often erected. In any case boundary fences were the second stage in the fencing programme because fences around crops and young grass took precedence. The third stage went hand in hand with the final clearance of the bush, the spread of pasture, and the increase in livestock. This stage was the erection of permanent fences to subdivide the farm into a system of fields.

Being forested country it is not surprising that the cumbersome post and rail fence was ubiquitous in the early years. Splitting the posts and rails out of tall timber in the bush, morticing the posts, pointing the rails, and transporting them was a long job compared with erecting the fence. For example, in 1882 one boundary fence took only two and a half days to erect but at least six and a half days to get the posts and rails ready on the line. A considerable amount of time had to be spent in regular checks on such fences and in repairing damage caused by marauding stock or by fires that had got out of control. Wire was rarely used at first, only one instance being recorded for 1882, and this was still in association with a two-rail fence. By 1889, however, wire fences were common on the developed land and in 1900 wooden gates were being made to replace some of the 'Taranaki' gates, those notorious barways made out of wire and battens.

Although an important activity in terms of time and function, fencing was not in the main determined by special seasonal requirements (*Fig.* 2). Thus the pattern from year to year shows considerable variation but with a tendency towards a concentration in the winter season.

The time devoted to livestock cannot be accurately measured as the daily task of milking the cows is seldom indicated in the diaries. Further, the regular chores of feeding pigs and the winter feeding of animals seldom occupy sufficient time to be recorded in terms of units of half a day's work. These tasks were largely done before breakfast or before the main task of the morning, or following the main work for the afternoon. Moreover, the womenfolk and the youngsters frequently carried out these tasks.

The Role of Livestock

Nevertheless, some indication of the role of livestock from year to year can be obtained (*Fig.* 2). The bargraphs show clearly the increasing time given to animals as their numbers grew. For 1876 only cows and horses are recorded and, as only six cows appear to have been kept on the farm, little time was required for them. Indeed, what time is recorded was largely occasioned by the search for cows and horses straying away and getting lost in the bush.

By 1882, pigs were also being kept and with an increase in the number of dairy cows the demand in time is greater. Ringing pigs, branding cows and calves, and looking for straying stock account for most of the recorded activity. Further livestock numbers demanded still more time in 1889, even to the extent of a full morning's work for winter feeding. This involved feeding turnips, carrots and chaff to the cows, boiling carrots to fatten the pigs, and carting straw as bedding for pigs and calves. The quantity of milk was by now so large that often an entire morning each week was needed to churn it into butter, to salt and to put it into kegs ready for the market. Sometimes during the warmer weather the butter had to be put down the well to cool before it could be fully worked.

Sheep had entered into the farm economy by 1900 and dipping, lambing and shearing were new activities. Still more cows and calves meant more branding and feeding. By May in 1900, cows were being fed on carrots and later on straw or green oats. Whereas in previous years there were very few surplus young stock for sale, in 1900 one steer, six yearlings and five calves were sold at the Waitara sale.

A comparison of 1889 and 1900 does not suggest the significant increase that occurred in the role and number of dairy cows. The principal reason for this is that the home dairy had been supplanted by a local factory which, despite numerous mechanical difficulties and a small milk supply, was a great improvement for the dairy farmers.

The actual stock numbers are not recorded in the diaries but it is possible to get a close estimate of the number of dairy cows from the records of calving. For dairy produce, records of the number of kegs of butter are available for the first three years and for 1900 the amount of milk taken to the factory is recorded. The average production per cow for 1876 is very low but this is explained by the diversion of some production into cheeses made on the farm by the womenfolk. Over twenty cheeses were made during the year, but this practice did not continue into the later years. The higher figure of 200 lb of butter per cow in 1900 appears to be due, in part at least, to the fact that all the milk is recorded whereas for 1876, 1882, 1889 some of the home-made butter was consumed on the farm and may not have been recorded as production. Nevertheless, some improvement in production per cow in 1900 is evident but even the figure for 1900 was less than half the average production per cow today.

TABLE I

ESTIMATE OF NUMBER OF COWS AND AVERAGE PRODUCTION PER COW FOR FOUR SELECTED YEARS

Year	*Number of Cows*	*Average Annual Production of Butter per Cow*
1876	6	116 lb
1882	12	151 lb
1889	16	142 lb
1900	24	200 lb[8]

In order to maintain a milk supply throughout the year the calving in 1876 and 1882 was not concentrated in any particular period. By 1889 spring calving was well established with thirteen of the sixteen cows calving in September, October and November; in 1900, ten of the herd of twenty-four calved in October.

HELP AND HINDRANCE

A Taranaki bush farm was not exempt from the handicaps of weeds and pests. The rapid growth of fern required the burning of potato land in 1876. Gorse and thistles were grubbed in 1882 and blackberries in 1900. The most notable pest was the bird, especially the sparrow. In 1882 the sowing of wheat was always attended by a large flock of birds. Poisoned wheat had to be used and in one morning alone some 180 dead birds were counted on one wheat field. The children were kept home from school at sowing time in order to frighten the birds away by shooting. In 1889 the record shows that birds were still a major pest. They flocked in when oats were cut and the children were again kept home from school to scare them off the grain.

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[8] This figure is obtained from the average production per cow in 1900 of 3,790 lb of milk at an average recorded test of 4.3. This quantity equals 163 lb of butterfat; 80 lb of butterfat equal 100 lb of butter.

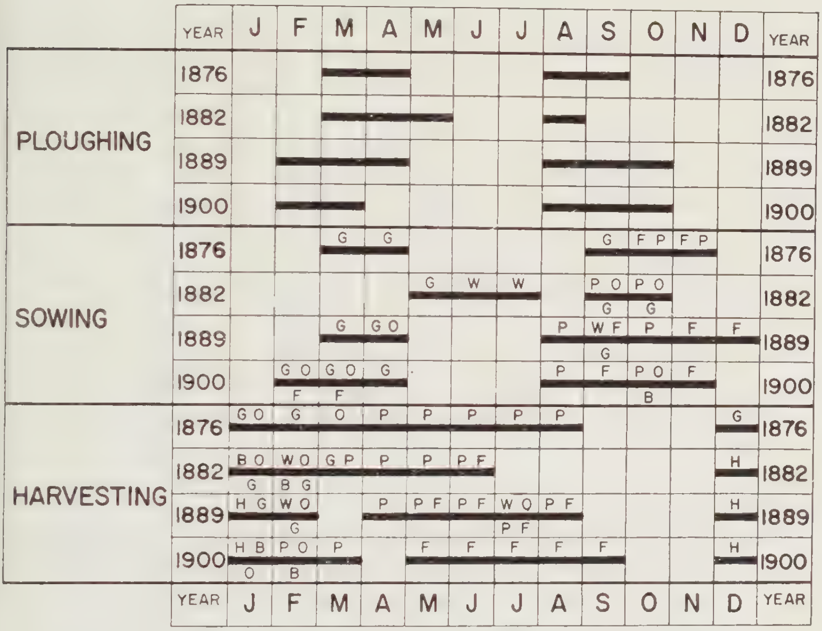

Fig. 4. The cropping calendar for four selected years (B—barley; F—fodder crops; G—grass seed; H—hay; O—oats; P—potatoes; W—wheat)

Life was made unpleasant at times by the weather. On wet days milking was sometimes omitted. Unfavourable weather occasionally caused delays in sowing down crops, while in November of 1889 and in January and February of 1900 hot, dry weather with southeast winds brought very smoky skies from the wild fires of bush burns away inland.

Difficulties with the Maoris still occurred in 1876 but Maori labour was of considerable assistance at harvest time. Cutting of cocksfoot grass was done by them for ten shillings an acre plus grog at the completion of the task. In 1882 several roving bands of Maoris competed to cut and thresh grass for seed and, in 1889, they were employed at harvest time.

The Balance Sheet

The development of the farm has so far been analysed largely in terms of the use of the land. It is clear that the use of the land varied from one year to another, particularly in the emphasis among cropping, pasture and livestock. The reasons for this variation were only in part a result of the technique of clearing the bush and creating pasture. Of considerable importance were the general economic conditions and a reasonable measure of their impact on the progress of farming can be obtained from the financial affairs of the farm. In one sense the success or failure of farm development can be measured in terms of the financial balance sheet and the manner in which the transactions therein were performed.

In 1876 the amount of cash handled was not very large. The biggest item was from the sale of the main crop of grass seed, some 1,240 pounds at sixpence a pound. To sell this however it was necessary to enter into a contract with the merchant to buy flour for the year at fourteen shillings per one hundred pounds. Butter in kegs was traded in New Plymouth but no cash changed hands for it was bartered for necessary supplies. Felling bush, fencing, ploughing and roadwork brought in many small but important amounts of cash throughout the year. Generally the wages were from eight shillings to an occasional fifteen shillings a day. Money on loan was difficult to obtain even on reasonable security. As early as March 1876 an agreement had been made to sell next year's grass seed to a New Plymouth trader at $5\frac{1}{2}$d. per pound. Another source of cash was from the sale of potatoes but overall a barter system with merchants was the key to trading.

The barter system still operated in 1882. All the grass seed (some 4,500 lb) was traded in this way. Small barter transactions were also entered into; for example, payment for repairs to the axle of a cart was in terms of six hundredweight of potatoes. No money changed hands for butter either, the value of the produce being credited against outstanding accounts. By the middle of winter the value of butter had risen from sevenpence to elevenpence a pound and, with the increase in price during winter, there was associated a changeover from salted butter to fresh butter in kegs. The sale of wheat in 1882 returned some cash. From four-and-a-half acres, 6,750 lb of wheat were harvested to yield almost twenty-five bushels per acre which seems to have been a common figure in the district. At four shillings and sixpence a bushel, wheat was a valuable source of ready cash. Fungus continued to provide cash and Chew Chong, the well-known personality in this trade, was paying fourpence a pound for fungus and giving a five percent commission. Most of the fungus traded was bought from the Maoris who spent much of their time collecting it in the district. The sale of potatoes, roadwork and the hire of one's labour to neighbours brought in small sums of cash at various times of the year. All these various activities were vitally necessary as money was expensive to borrow at interest rates of approximately nine percent.

Adversity

The diary for 1889 indicates some of the difficulties posed by the economic depression of the 'eighties. This was generally a most uncertain period for the farmers. By 1889 butter was no longer traded for goods but was being bought by the traders for cash, this in itself an important advance. However it was difficult to sell in New Plymouth during the seasonal flush, even at very low prices. Therefore a number of attempts were made to open up markets elsewhere. In March 1889 six kegs, each of sixty pounds of salted butter were shipped privately to Sydney for a gross return of one shilling a pound compared with the ruling prices of 8d. to 8½d. in New Plymouth. Another consignment was sent privately to the Wanganui area and returned 8d. a pound. However, as these markets were liable to considerable fluctuations the trade was speculative. Fresh butter had a sale during the winter but by October the price had fallen to only 6½d. a pound and the market now demanded salted butter in kegs. These were sold to traders who advanced sixpence a pound on it before sending the produce to the English market. By December the cash advanced on butter for the English market was reduced to threepence per pound and, with the need for cash, the kegged butter was now sold on the New Plymouth market for sixpence or sevenpence rather than wait for a possible higher return from the English market.

Marketing of other products was also difficult. The harvest of cocksfoot seed had decreased to only 460 lb but this small quantity was difficult to sell, even at 2½d. a pound and had to be released on to the market one bag at a time. The crop of fifty bushels of wheat was bartered to the mill for flour but the exchange rate was considered to be low—thirty-eight pounds of flour against each bushel of wheat—plus a high price of a shilling per bushel for the cost of grinding. In view of this difficult economic condition it is not surprising that contracts for roadwork and bridge building were eagerly sought, particularly during the winter months. Other farm produce was sold, whenever available, and eggs and turkeys became regular sources of small amounts of cash. Potatoes were no longer grown in large quantities, as formerly.

There is no doubt that in 1889 the margin between financial success and failure was very finely drawn. There is evidence that by the end of winter virtually no ready cash was left. Under the impetus of low prices for butter on the New Plymouth market the local farmers met during the year to consider a cooperative dairy factory, to replace the individual churning of butter and the uncertainty of private sales to trading stores. The discussions were eventually to mature into a cooperative dairy factory.

Prosperity

By 1900 farming had entered into a new and more prosperous era in which refrigeration played a vital role for the dairy farmers. No longer was it necessary to seek wage work outside the farm. No longer was a barter system of trade in operation. No longer were grass seed, wheat and potatoes grown for sale. No longer was butter laboriously churned in the home dairy for hopeful sale on uncertain markets at marginal prices. In place of the earlier economic pattern there was now a regular monthly milk cheque from the local dairy factory and an annual bonus paid out in winter when the milk return was smallest. Milk was now the major source of income; all others were insignificant.

Not only was a ready cash income assured but more cows gave more milk for reasonable financial returns at regular intervals. The standard of living for the family, now large in number, showed a very substantial improvement. In social terms, likewise, there were more periods of leisure and community entertainment. The development of community services had broken down some at least of the earlier handicaps of isolation. Visits to New Plymouth and, particularly to the growing townships of Waitara and Inglewood were more numerous. Admittedly, travel to these centres was still by horse and cart on most occasions. The New Plymouth–Waitara railway, although opened in 1875, played little part in the development of the farm but it now filled a more important role in the carriage of heavy and bulky commodities, notably fertilisers.

Conclusion

As W. R. Mead has written, 'Geography focuses attention upon patterns on the face of the land . . . (and) . . . the patterns are continuously changing, short period and long period changes proceeding simultaneously . . . .'[9] One of the clearest changes is in the adjustment of activity to the cycle of seasons and the first purpose of this paper has been to represent the time factor in the seasonal activities for the four selected years on a specific farm during the course of its development out of the bush land of North Taranaki. The second purpose has been to use this material, and other records in the diaries, to show more precisely the actual processes involved in the making of a dairy farm.

It is not possible to classify, measure and represent the cost, in terms of mental and physical strain, of transforming the farm from bush to pasture during the twenty-five years or for the four selected years. For this one must read what was written in the diaries and also between the lines. Periods of sickness were not infrequent; hands and legs were gashed by axe, knife or branch; backs were strained and lungs impaired by work in damp forest. For the womenfolk, childbearing must have seemed almost endless yet they had a full round of chores in the house and beyond. Little wonder that the diaries record many times when the housewife, butter and cheese maker, and mother was at the end of her tether. Yet, on the Sunday strolls around the farm with the children, or with visitors, an element of pride and satisfaction must have been present although unrecorded.

In this particular case study it may fairly be claimed that by 1900 the tribulations of the pioneering period had ended. From a basically subsistence economy and a land that was largely covered in bush, there had developed a profitable commercial enterprise and a farm of pasture, livestock, fodder crops and fences. The transformation in form and in function within twenty-five years was very great. There still remained land to stump, swamps to drain, and pastures to establish but these were tasks for which the techniques had been established and proved successful.

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[9] Mead: *op. cit.*, p. 157.

Essentially, the challenge of the future was one of improvement of fertility, pastures and herds but that challenge was to be taken up by the pioneer's sons and their sons, and that is another story.

COROMANDEL: A STUDY IN ECONOMIC STAGNATION

E. E. OWEN

COROMANDEL, with a population of less than seven hundred people, is a small township on the west coast of the Coromandel Peninsula. It occupies the northern portion of a small coastal flood-plain, and its sheltered harbour is girded by islands. Two outlets serve the township: the sea route to Auckland which was a vital link from the town's origin until the interwar years, and the now important foreshore road route southwards to the railhead at Thames. Four mountain roads converge on Coromandel. Three roads cross the Coromandel Range from Kennedy Bay, Te Rerenga and Whitianga on the east coast, and a north road with a minor network of branch roads extends to Port Jackson and Port Charles. All these routes negotiate the mountainous terrain of the peninsula where ridge lines average 1,500 feet in height and many peaks rise above 2,000 feet.

Coromandel is essentially a 'one street' settlement. Winding from the wharf for one and a half miles to the foothills of the ranges, the street is lined by a haphazard arrangement of dwellings, halls, churches, public buildings and industrial units. Only the shopping centre can be distinguished as an area of uniform function and character. Open spaces between buildings is a prevalent feature and the resultant effect is an untidy, sprawling and attenuated settlement (*Fig.* 1).

The township has a number of singular components. For a small town there is an unusual aggregation of public services which, among other things, is indicative of its role as the administrative centre of a county. It has six moderately-sized halls, four commodious churches, two licensed hotels, a hospital, a variety of recreational facilities, and a mussel-canning factory which is unique in New Zealand. Most manifest, however, is the architecture and design of the buildings, a visible element which discloses past growth and succeeding change.

Very few dwellings have been built in Coromandel since the first World War. The austere lines of three state houses, the modern designs of a few bungalows, and the 'arts and crafts' styles of occasional houses constructed in the interwar years appear incongruous in the dominantly

Victorian colonial architecture. Predominantly buildings are made of kauri timber, and sash windows, iron roofs, verandahs and stud foundations are common. The small colonial cottage with brick chimney, gabled roof, lean-to and simple interior four-part division can still be seen in its original form, although many bear the mark of modification with glassed-in verandahs and multiple lean-tos behind. In contrast are the spacious residences built by the wealthier colonial, with their pretentious bay windows, ornate fretwork and extensive verandahs. However, many buildings have been used for various purposes since first being constructed. The original Salvation Army Hall, for instance, has been a Drill Hall, Council Office and 'Colour Centre'; an old mining office is now a neat dwelling house; and the double-storeyed, mid-Western style 'Star and Garter' hotel now serves as a motel.

Such is the general picture of Coromandel today. Although it could be described as a small rural settlement, the township nevertheless contains elements consistent with a larger urban area. An examination of its origin and development will assist in interpreting its present-day character.

The Colonial Gold-Mining Town

A safe anchorage in a sheltered estuary and readily-accessible kauri forests obviously attracted early European settlement. As early as 1830, timber traders, runaway sailors and convicts had established themselves in the vicinity of the present township. It was in 1852, however, when a timber worker, Charles Ring, discovered gold in Driving Creek in the present upper town area, that Coromandel's vigorous and colourful but chequered era of gold extraction began. For half a century periods of rushes and excitement after new 'strikes' were followed by slump and withdrawal as claims were worked out. After Ring's discovery about three hundred diggers arrived in Coromandel, but six months later few were left. In 1861 a discovery at Kapanga brought another rush, and the following year the district was proclaimed a goldfield. Between 1867 and 1870 more discoveries attracted hundreds of diggers, and during the following thirty years the construction of dwellings, stores, hotels and public buildings firmly established permanent settlement. In 1874 a census revealed that there were almost 1,200 people residing in the township, but numbers dwindled during the slump of the 1880s. The final boom occurred in

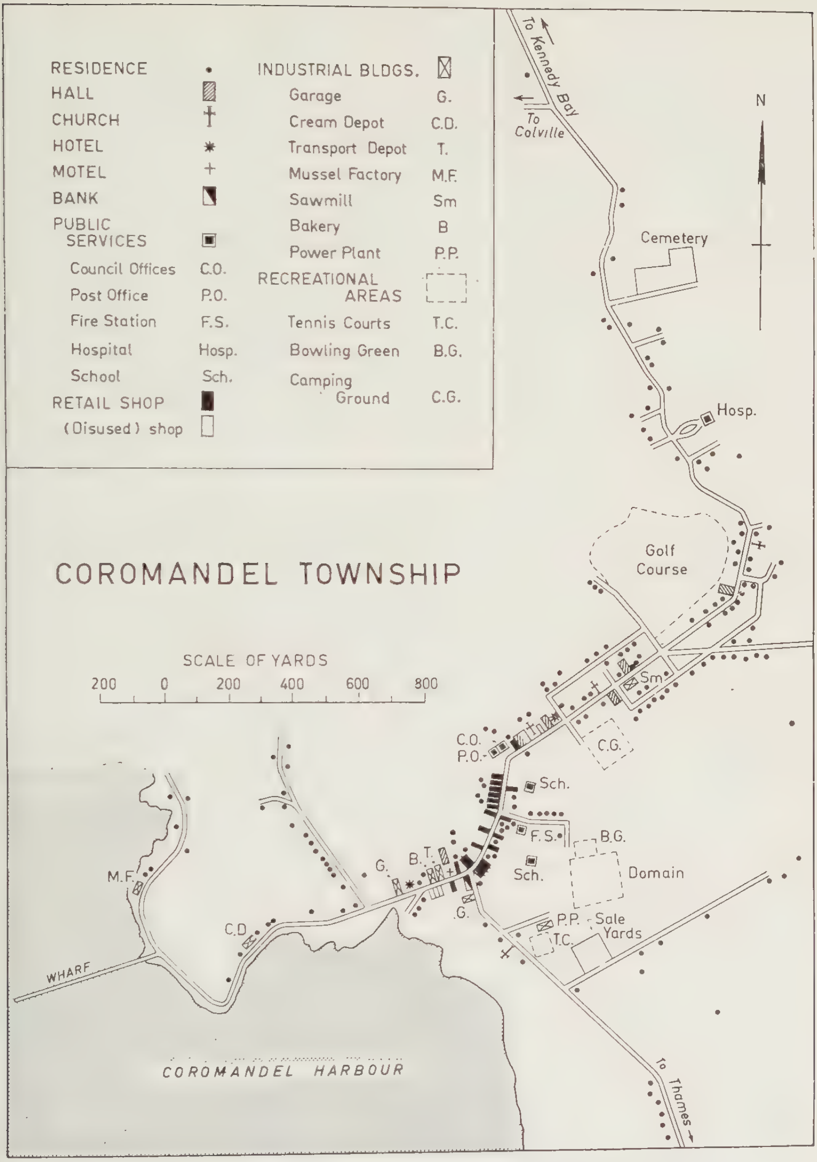

Fig. 1. The pattern of Coromandel township 1960 (note:— the blank rectangle between the church and hall in the main street is a cinema)

the 1890s when rich lodes discovered in the Hauraki mine stimulated fossicking in other fields on the peninsula. In the last few years of the nineteenth century Coromandel was at its zenith as a gold-mining centre, typifying in its form and activity the attributes of colonial success in the exploitation of resources.

Over one thousand miners were actively engaged in the Coromandel mining district and one half of these worked and lived in the township, the population of which in 1896 was 1,527. On Tokatea Hill, a few miles to the east, more than two hundred diggers were engaged and the hillside was burrowed like a rabbit warren with drives and shafts. At Kuaotunu on the east coast, a further two hundred diggers were active and such was the optimism of the time that a narrow-gauge railway was contemplated from Coromandel to this settlement, but the project was abandoned after an investigation of costs. Smaller groups of miners elsewhere on the northerly goldfields of the peninsula, and timber workers still active in the western watersheds looked to Coromandel as a supply and social centre.

From the wharf area, where vessels arrived daily from Auckland and scows discharged coal from Hikurangi, the township stretched for nearly two miles past the Kauri Block mines through Kapanga, the lower town, to the mines around Bay View, Buffalo and Belleville, the upper town. The lower town had a more permanent appearance with its closer settlement and larger number of commercial enterprises. The upper town contained dozens of roughly-built temporary cottages and *whare*, and tents were even used as dwellings. Overall, however, hotels, offices, halls, churches and numerous nondescript retail shops-cum-dwellings were scattered along the main street. At almost every turn poppet heads, mine stores, races, tailings and tramways could be seen against a background of denuded and disfigured hillsides. The roar of the many batteries, the grime from the brick stacks of coal-fired boilers, and the constant movement of quartz-filled drays were indicative of a flourishing gold town.

Decline and Adjustment

Auriferous reefs of the Coromandel field were limited in extent and contained gold in the form of small but rich 'specimen' stone. After the rich finds in 1896 only very limited discoveries were made, and the decline of the gold industry was rapid and complete. By 1902 many companies had ceased operations, tributers were working in the levels, and the Director of the School of Mines in his annual report was lamenting the 'rather small number of students . . . [being] . . . solely accounted for by so many leaving the district in search of work'.

Many miners moved to the Thames and the rapidly-expanding

Waihi goldfields. There was little opportunity for farming on the rugged terrain of the peninsula. Timber milling in the western watersheds, which had continued during the gold-mining period, was slowly declining as accessible trees were removed. It was now giving way to the backyard manufacture of fence palings and axe handles and to the collection of firewood for the Auckland market.

The wane of extractive industry was further evidenced by the erection of saleyards in 1908 and the opening of a dairy factory the following year. Farming during the nineteenth century was near subsistence in character, being small scale, sometimes a part-time occupation, supplying fresh produce to the mining community. After 1900, however, bush burning was intensified on the steep hillsides of the peninsula and hand-sown pastures were established for sheep and cattle runs (*Fig.* 4).

Coromandel survived as a servicing centre for the new farming community. The population fell rapidly to below one thousand and has declined slowly since (*Fig.* 3). Settlement has retreated towards the lower township leaving behind solitary dwellings and derelicts as visible evidence of a snail-slow adjustment to a changed function. Garages have taken the place of stables, the large number of licensed premises has been reduced to two, retail establishments have grouped into a shopping centre, and poppet heads, mine buildings and other associated paraphernalia have disappeared.

Servicing Centre

Except for the east coast hinterland of Mercury Bay served by the rival town of Whitianga, Coromandel serves an area roughly coincident with the county boundaries (*Fig.* 2). It is the centre of county administrative services, of postal, medical and professional services, and of commercial services such as food distribution, general retailing and farm servicing, and is a focus for social, cultural and educational activities. To the bulking depot cream is forwarded from the extensive upland area for onward transit to the dairy factory at Ngatea on the Hauraki Plains. The dominance of the township in the region is diminished only by the presence of wharf facilities at Otautu (Colville Bay), Port Charles and Port Jackson where supplies from Auckland, principally for farms, enter the area.

The economic character of the township must be considered, therefore, in the larger context of the area it serves. A measure of this

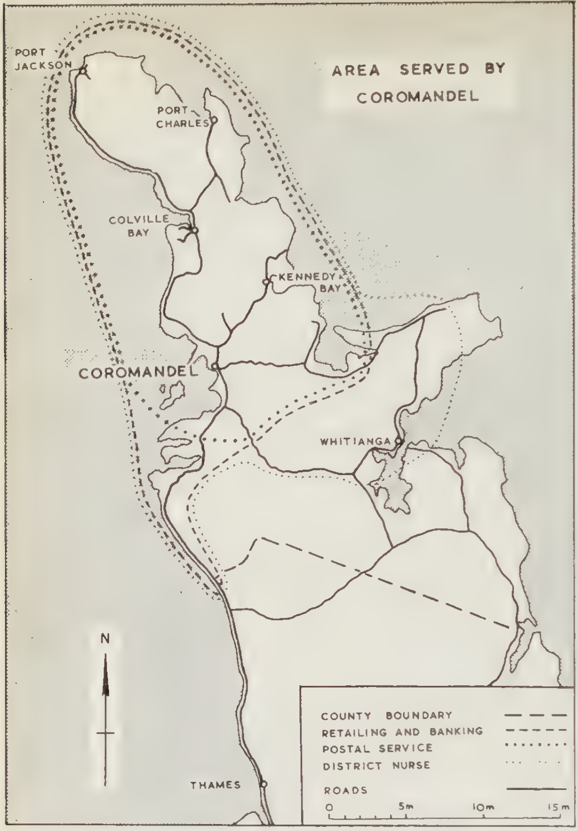

Fig. 2. The servicing area of Coromandel township in relation to the county boundary

character is indicated by the occupational structure of employed persons (Table I).

Considering the small population there is a large number of persons engaged in servicing activities such as public services, retailing, and transport. In addition, one third of those persons classed as 'Industrial'—the bakery and bulking-depot workers—may be similarly classified. Only fourteen men employed in sawmilling, commercial fishing and building, and seven in agricultural pursuits are engaged in activities not directly related to servicing. The mussel-canning factory employs fifteen to twenty people, mainly female, on a seasonal basis, but since it operates for about three months only each year, these have not been included in the table. Thus emerges a composite picture of activity almost exclusively servicing in nature, and an examination of each activity in detail illustrates further characteristics of the township.

The county administration, post office and hospital provide efficient services over a large area of the peninsula considering the problems of distance, poor roads and isolation. The county council, which operates on a low rate levy, is faced with the constant task of maintaining road surfaces in an area of frequent slips and washouts, and the accumulation of funds for capital development is almost precluded. Some local services—fire, ambulance and library—rely entirely on the enthusiasm of voluntary help. The hospital, the only one on the peninsula north of Thames, and the district high school are frequently understaffed, and difficulty is experienced in retaining a doctor in permanent residence.

One third of all occupied persons are engaged in the retail trade, the market area covering the northern half of the peninsula (*Fig.* 2). All the retail shops are small units, and many of them are owner-operated, the exception being a branch store where six people are employed. The shops dealing principally in food items are probably the most prosperous, but trading in a number of commodities is common. With a stable population in the market area, an absence of even moderately competitive trading, and the limited capital of small businesses, large stocks of goods are not carried. The flow of wholesale supplies into Coromandel therefore, usually takes the form of small consignments to fulfil individual orders or make small additions to accumulated stock.

TABLE I

OCCUPATIONAL STRUCTURE OF COROMANDEL*

Occupation	*Number Employed*	*Approx. Percentage*
Public service and professional	38	30
Agricultural	7	6
Industrial	23	19
Retailing and hotels (including proprietors and assistants)	40	33
Transport (including garage workers)	14	12
Total number of workers	122	100
Retired	106	—

Transport costs in the area are high, and are accounted for by the sparse population, long distances, small volume of goods carried and difficult roads which limit speeds. Sea transport is slow and infrequent. Although only thirty-five miles from Auckland, a one-way sea trip takes five hours and there are only two sailings a week. Because of harbour silting in recent years only shallow-draught vessels can approach the wharf for a limited time at high water. The decline of the coastal sea traffic along the northern coasts of the North Island has been paralleled by Coromandel's increasing need for better roads to serve the farming community. Road construction has been slow so far and there appears little likelihood of any considerable development in the future.

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* Information obtained by interview. All the houses in the township were visited and 425 people were concerned. Almost all the women gave their occupation as housewife.

POPULATION AND PEOPLE

The population of Coromandel has shown a slight decrease at each census since 1936. The county population has increased slightly during the same period (*Fig.* 3). In the survey detailed in Table I, out of 425 people twenty-five percent were over the age of sixty and thirty-five percent under fifteen. There were only nine percent between the ages of 15 and 30 and thirty-one percent between 30 and 60. This abnormal age structure may well be characteristic of isolated settlements with limited resource potentials in the areas which they serve.

The lack of opportunity for young people to obtain skilled employment and the limited variety of jobs have serious consequences for the township. There is an annual exodus of school leavers to urban centres in search of work and families with teenagers are faced with the alternative of a break-up of the family unit or a wholesale family move. The census figures indicate that migration has overtaken the rate of natural increase in the township, yet indications are that the rate of natural increase in the county is high, for an average of forty births and only twelve deaths per annum has been registered at the Coromandel post office since 1946.

The presence of a large number of retired people in the township is an indication of its cohesive social ties. Many people who leave the township for economic reasons return on their retirement. There are attractions for such folk—cheap land and housing, a slow tempo of life, favourable climate for gardening, and opportunity to live cheaply. There is a proliferation of social, cultural and sporting clubs and societies, a fact which can be related to the size of the 'retired' age group (Table I). More than forty active clubs can be identified, and regular meetings, fund raising and outside visits result in a consistently busy social atmosphere which is far from obvious on casual acquaintance with Coromandel. This tightly-knit and warm social life is in marked contrast to the anonymity of city life where the individual tends to become a detail in an economic entity or herds together for entertainment.

The preponderance of very old and very young persons does, however, draw attention to the dormant economic condition of the township. Energy and enterprise are essential qualities if development schemes are to be initiated and implemented. The apathy characteristic of old mining towns is still discernible today, and the situation is not aided by the steady migration of younger people and by the difficulty of accumulating capital where incomes are mainly derived from government benefits and pensions, salaries and wages and profits from small-scale retailing.

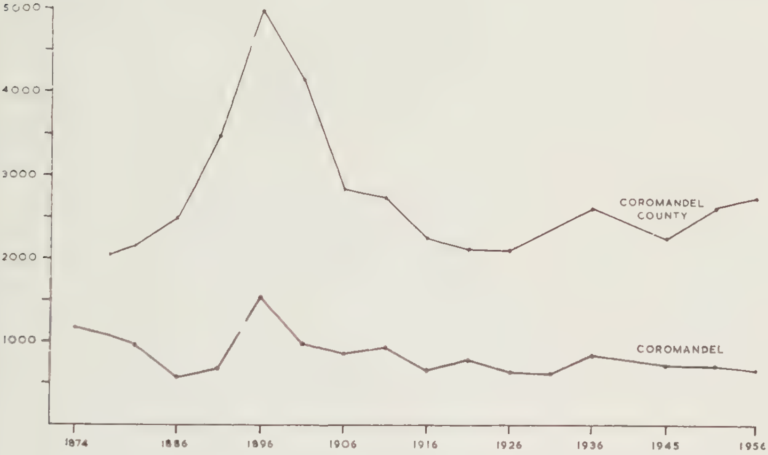

Fig. 3. Population changes in Coromandel county and Coromadel townnship

Prospect

Two different and unrelated developments in recent years, in farming and in the tourist industry, have tended to dispel the economic gloom which was descending on Coromandel.

By 1936, 74,000 acres, or one quarter of the area of the county of Coromandel, had been surface sown after bush burns. Store sheep and cattle were universal on the steep hills where poor soils, derived mainly from andesite and greywacke, supported pasture associations with danthonia dominant. By comparison, the limited coastal plains with alluvial soils were intensively utilised and dairy herds were typical.

Without the addition of fertilisers, however, the hill pastures deteriorated as soil fertility declined, and autumn burning-off, although rejuvenating rank danthonia, could not prevent the spectre of reversion to scrub and abandoned holdings. By 1952, on 23,000 acres, pasture establishment had failed and the farms had been abandoned.

A windfall, two innovations and government aid have brought relief and hope for the hill farmers in the last decade. The windfall came with the high wool prices in 1951 when enlarged incomes provided funds for capital outlay and payment of debts. The innovations were more important. It was discovered that the hill soils were deficient in the trace element, molybdenum, and this discovery coupled with the advent of cheap topdressing by aircraft produced a quick response in pasture growth. One farmer using molybdenum superphosphate reported in a short period an increase of fifty percent in wool weight. By 1957 there were ten landing strips in the county and nearly one third of the acreage topdressed was topdressed by aircraft. Finally, the Marginal Lands Act enabled farmers occupying land marginal in character to receive financial assistance in order to raise productivity to a point where the land became economic to farm. This legislation has assisted a number of farmers to develop their farms where previously there was little alternative to financial loss and

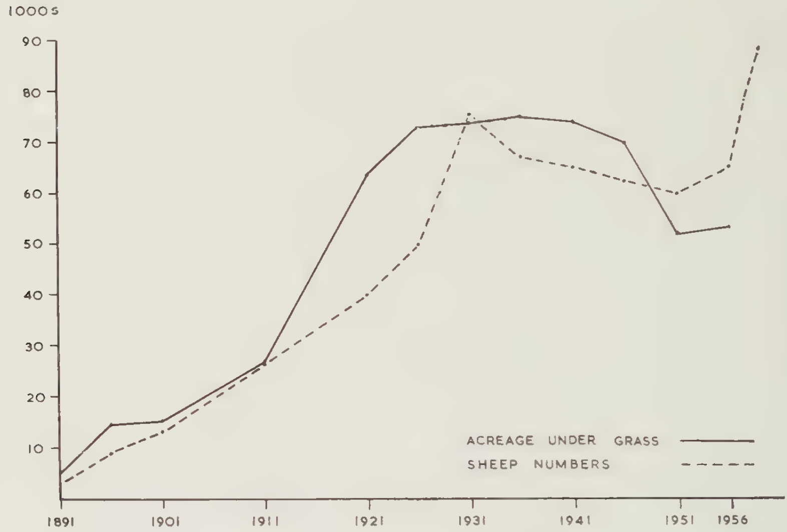

Fig. 4. Sheep numbers and grassland acreage in Coromandel county, 1891–1956 abandonment. Carrying capacities are now higher than at any time previously. Although the acreage under grass has increased very little since 1951, sheep numbers have increased by approximately forty-seven percent (*Fig.* 4) and dairy cows by nearly eleven percent between 1951 and 1959.

The outcome of these developments has been that farm potentials have been lifted higher than previous assessments, the processes of land improvement are outweighing the processes of land deterioration, and credits are obtainable on a more liberal basis. Nevertheless, there is a wide disparity in farm management between individual farms, and in some areas of potentially valuable land clean paddocks are rare. Future economic progress for most farmers is dependent upon favourable market prices for wool and, for some farmers, a willingness to accept expert advice.

Tourist Traffic

The large and rapidly increasing population in Auckland and South Auckland and the growing numbers of private motorists are factors which can be related to the tourist traffic which has developed in Coromandel during the last six years. Upwards of 5,000 people are estimated to be in the vicinity of the township at the peak of the six-week summer season, a 'rush' far exceeding the highest estimate for a goldrush in the mining days. The chief attractions are the scenic beauty of the coastline and ranges, the fishing grounds, beaches, sheltered anchorages for pleasure craft, the romantic appeal of an old gold town, and camping facilities. The southern coastal road is the principal inlet for this traffic, and Coromandel, as a convenient stopping place for tourists proceeding northwards to Colville, Port Charles, Port Jackson and Kennedy Bay, serves as a tourist route centre as well as a resort in its own right.

The recency of the tourist traffic precludes a definitive statement as to its permanence. The attractions mentioned can be equalled by settlements on the eastern coast of the peninsula where more expansive beaches and the proximity to big-game fishing grounds are added features. As a tourist route centre Coromandel has a site advantage as long as road access to northern beaches is confined to the sole western route. Local amenities have been developed to attract tourists, notably camping grounds and motel accommodation. Retail traders have benefited from the traffic but enterprise and funds are needed to provide further attractions and facilities, not the least of which are a deep-water wharf to encourage sea excursions from Auckland, and the preservation and exhibition of old buildings and sites.

CONCLUSION

Coromandel is a small, isolated settlement which discharges the functions of a town for an extensive, sparsely-populated, upland area. It contains urban features commonly associated with a larger settlement and its complex of administrative, trading, servicing and social features is indicative of this.

The vicissitudes of the colonial period with its goldrushes and withdrawals were followed by a long period of economic stagnation and slow adjustment to a change of fortune, relieved only by recent developments in agricultural productivity and the advent of a tourist trade. As a servicing centre its future prospects must be weighed against the potentially farmable land and the extent to which the land already farmed can be further developed. Future intensification of land utilisation will be gradual and cannot possibly absorb labour surpluses. In the absence of industrial development, extractive or secondary, on a large scale, continued migration seems inevitable.

AUSTRALIAN FISHERY PROBLEMS AND PROSPECTS

H. W. H. KING

FISHING and whaling have played only a minor part in the economic life of Australia. Perhaps they will never be important activities but several recent developments suggest that they might well become more significant contributors to the national economy than in the past.

The history of fishing enterprise in Australia is brief and undistinguished. Whalers (and sealers, at times) have operated intermittently from a few mainland and Tasmanian bases since 1798,[1] but the continent's fishery and other marine resources received little commercial exploitation till comparatively recent years.[2] Trawling in offshore waters dates from May 1915, when three state-owned vessels began operating in a small way off the New South Wales coast. Their activities were restricted to two isolated areas—the 'home grounds', of about 200 square miles, extending from the vicinity of Sydney south to Wollongong, and the 'southern grounds', an area of about 300 square miles, stretching south from the neighbourhood of Merimbula to just north of Cape Howe.

Owing to the disruptive effects of the first World War and the policy changes of successive governments the fishing industry did not thrive in its infancy. The New South Wales government sold its vessels to private operators and until 1945 the industry made only slow and spasmodic progress.[3] Thereafter it expanded largely as the result of several tuna and other hitherto unsuspected pelagic fisheries being discovered, and of many new prawn, crayfish and demersal fishing grounds being located.[4]

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[1] For an historical account of whaling in Australian waters and other southern seas see W. J. Dakin: *Whalemen Adventurers*, Sydney, 2nd ed., 1938. A short account of sealing is given in Rosaline Redwood: 'Early Sealing Days', *Walkabout*, Vol. 9, No. 3, Melbourne, 1943, pp. 4–8.

[2] See 'The Marine and Freshwater Fisheries of Australia' in *Commonwealth Year Book*, No. 17, pp. 752–767; T. C. Roughley: *Fish and Fisheries of Australia*, Sydney, 1951, pp. 172–3.

[3] For accounts of the condition of the Australian fishing industry up to the end of the second World War see J. F. Herlihy: *The New South Wales State Trawling Enterprise: Historical Record 1915–24*, Confidential Report to the New South Wales Government, 1927: Aust. (Comm. Parlt.): *Tariff Board's Report on Fishing Industry, 23 June 1941*, Govt. Printer, Canberra, 1941; W. S. Fairbridge: 'The Effect of the War on the East Australian Trawl Fishery', *Journ. Counc. Sci. & Ind. Res.* (C.S.I.R.), Vol. 21, No. 2 May 1948, pp. 75–98.

Special interest attaches to Australia's fisheries in their present stage of development, for, apart from the recent progress of the fishing industry, a comprehensive programme of fisheries research and development is actively under way.[5]

Fishing Production and Fisheries

Since 1952-1953, when Australia's fish production reached an all-time peak of eighty-one million lb live (or whole fresh) weight the annual catch has averaged about seventy-one million lb. In 1955-1956 production fell to sixty-four million lb and then fluctuated at seventy-four million lb in 1956-1957 and seventy-two million lb in 1957-1958.

The catch is dominantly marine and fresh-water species normally comprise only about three percent of the total. Although many varieties of fish are taken relatively few are commercially important: thus in the 1957-1958 catch (Table I), less than a score of species exceeded one million lb in production, and of these, mullet, Australian salmon and edible sharks accounted for nearly fifty percent of the catch. Callop was the only fresh-water species produced in excess of one million lb.

The fisheries can be classified in four categories: three—coastal, demersal and pelagic—are marine, and one—riverine—is freshwater.

Coastal Fisheries

The coastal fisheries consist of the shallow-water areas off sheltered beaches and in the many inlets, lagoons and estuaries along the coast, especially from Cairns in northern Queensland to Ceduna in South Australia, and from Albany to Geraldton in Western Australia (*Fig.* 1).

These coastal waters are Australia's most important fisheries in terms of their production to date. They have been exploited more intensively and for far longer than all others. In places they have been grossly overfished and, as a consequence, some waters have had to be closed in order to protect spawning and breeding grounds and to enable the depleted stocks of fish to recover. Nevertheless, the coastal fisheries still contribute substantially to the annual Australian catch.

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[4] Counc. Sci. Ind. Res. Aust.: *14th Annual Report, Melbourne*, 1940; D. L. Serventy: 'The Australian Tunas', *C.S.I.R. Div. Fisheries, Pamphlet No. 104*, Melbourne, 1941; M. Blackburn and A. M. Olsen: 'Recent Progress with Pelagic Fishing in Australian Waters', *Journ. C.S.I.R. Aust.*, Vol. 20, No. 4, 1947, pp. 34-44; H. Thompson: 'Australia's Fisheries, Investigations. Some Conclusions Reached During the Quinquennium 1938-43', *ibid.*, Vol. 16, No. 4, 1943, pp. 279-286; M. Blackburn and J. A. Tubb: 'Measures of Abundance of Pelagic Fish', *C.S.I.R.O. Bull. No. 251*, Melbourne, 1950; K. Sheard: 'The Marine Crayfishes of Western Australia', *ibid., No. 247*, Melbourne, 1949. Many reports on the progress of crayfish, prawn, pilchard and other fisheries surveys have appeared in *Fisheries Newsletter* (monthly publication of the Commonwealth Fisheries Office), especially since 1956 (Vol. 16 *et seq.*).

[5] *Fisheries Newsletter*, Vol. 16 *et. seq.* (*passim*); also, A. J. Fraser: 'The Fisheries of Western Australia', *Western Australia Fisheries Dept. Bull. No. 4*, Perth, 1953.

TABLE I

FISH: PRODUCTION OF MAJOR SPECIES IN AUSTRALIA 1957-1958

Common Name	*Scientific Name*	*Production**	*Percent*
Mullet	*Mugil* spp.	11,566	16.1
Australian Salmon	*Arripis trutta*	10,561	14.7
Shark	*Mustelus, Galeorhinus* *Squalus*, etc. spp.	8,241	11.4
Flathead	*Platycephalus* spp.	4,108	5.7
Barracouta	*Leionura atun*	3,903	5.4
Tuna	*Thunnus, Neothunnus* *Kishinoella, Katsuwanus* spp.	3,231	4.5
Snapper	*Chrysophrys auratus*	3,144	4.4
Morwong or Jackass Fish	*Nemadactylus macropterus*	3,100	4.3
Whiting	*Sillago* spp.	3,000	4.1
Leatherjacket	*Aluteridae*	1,658	2.3
Ruff, Tommy Ruff, Sea Herring	*Arripis georgianus*	1,563	2.1
Mackerel, Spanish and School	*Scomberomorus* spp.	1,460	2.0
Callop	*Plectroplites ambiguus*	1,300	1.8
Garfish	*Hemiramphus* spp.	1,139	1.5
Luderick or Blackfish	*Girella tricuspidata*	1,025	1.3
Bream	*Acanthropagus* spp.	1,024	1.3
Other fish	—	11,995	17.1
TOTAL PRODUCTION	—	72,018	100

* In thousands of pounds weight.

Source: Statistical Bulletin: Fishing and Whaling Australia No. 4, Comm. Bureau of Census and Statistics, Canberra, 1959.

Many kinds of fish are taken but the commercially-important species other than mullet, flathead, whiting, leatherjacket, garfish and luderick (Table I) include representatives such as flounder and sole

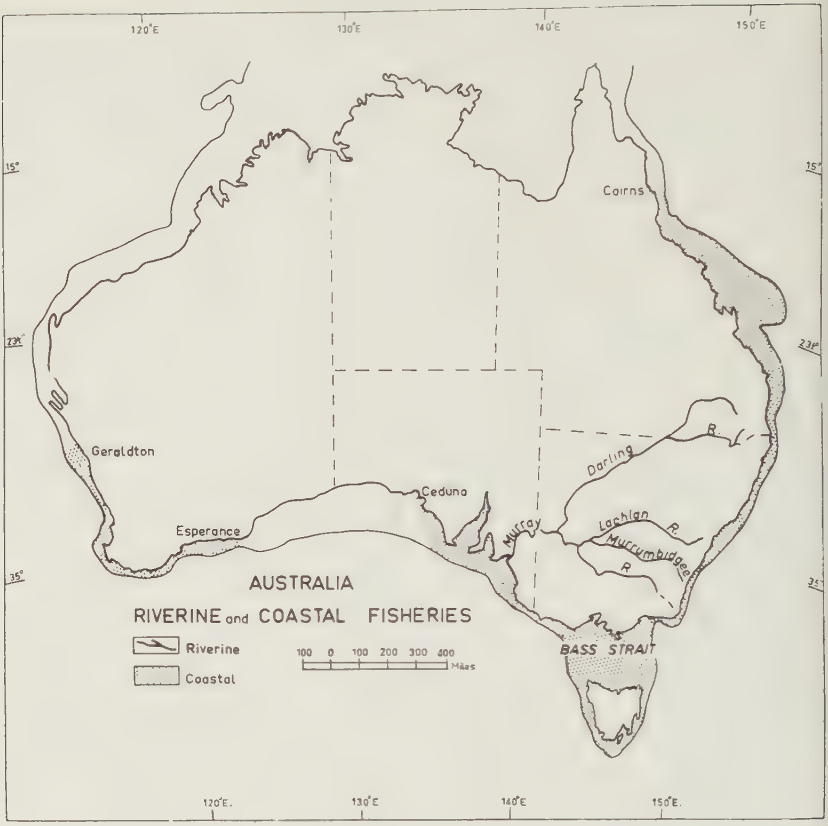

Fig. 1. The coastal and riverine fisheries of Australia

(*Rhombosolea*, *Pseudorhombus* and allied species) and mulloway or jewfish (*Sciaena antarctica*).[6]

During the last few years barramundi fishing has grown important in the Darwin area (*Fig.* 1). The barramundi, or giant perch (*Lates calcarifer*), which is highly prized for its edible qualities, is primarily a denizen of fresh-water rivers in northern Australia but it also inhabits the estuaries and coastal waters. It attains a length of nearly six feet and a weight of more than ninety pounds.

DEMERSAL AND PELAGIC FISHERIES

The demersal grounds comprise the reefs and sandy bottoms in the deeper waters off the coasts. They extend intermittently from north Queensland around eastern and southern Australia to Shark Bay in Western Australia (*Fig.* 2).

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[6] T. C. Roughley: *op. cit.*; J. D. Ogilby: *The Commercial Fishes and Fisheries of Queensland*, Fisheries Branch, Department of Harbours and Marine, Brisbane, 1954; T. C. Marshall: 'Know Your Fishes', *Ichthyological Notes*, Vol. 1, No. 4, Fisheries Branch, Department of Harbours and Marine, Brisbane, May 1959; F. Aldrich: *The Fishery Resources of Western Australia*, Govt. Printer, Perth, 1934.

As in the coastal waters, fish of many kinds are obtained from the demersal fisheries. The bottom-feeders of commercial significance include species such as cod (*Plectroplomus spp.*), groper (*Achoerodus gouldi*) and other tropical varieties from the warmer waters along the eastern coast; cod, snapper, nannygai (*Centroberyx affinis*) and morwong from the temperate coast reefs; flathead, principally from sandy grounds between Crowdy Head in central New South Wales and Cape Everard in Victoria; and elasmobranchs or sharks and rays of different species from southern New South Wales and Bass Strait waters.

Fish supplies from these offshore waters have been supplemented, particularly during the last few years, by large quantities of prawns of several kinds—notably school, king, tiger and banana prawns

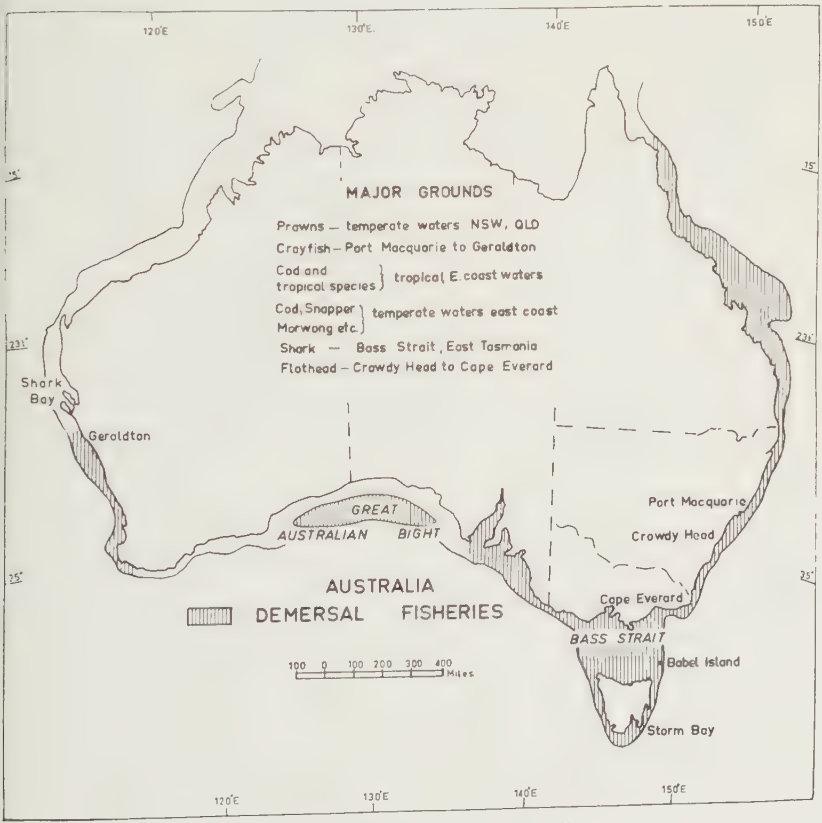
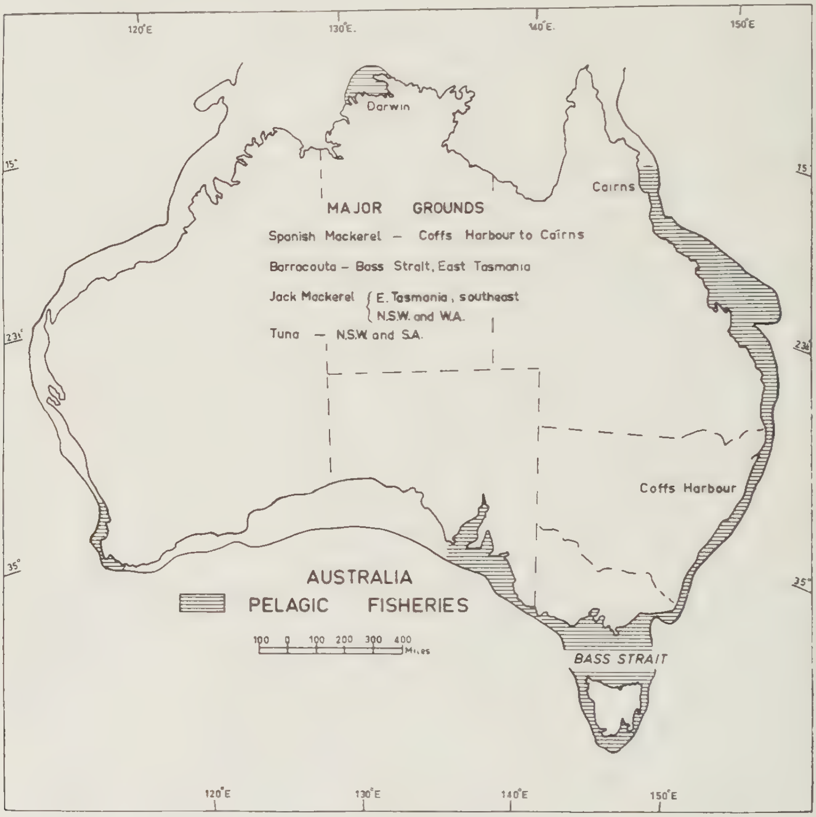

120°E
130°E.
140°E
150°E
15°
23½°
35°
MAJOR GROUNDS
Prawns — temperate waters NSW, QLD
Crayfish — Port Macquarie to Geraldton
Cod and tropical species } tropical E. coast waters
Cod, Snapper Morwong etc. } temperate waters east coast
Shark — Bass Strait, East Tasmania
Flathead — Crowdy Head to Cape Everard
Shark Bay
Geraldton
GREAT AUSTRALIAN BIGHT
AUSTRALIA
▥ DEMERSAL FISHERIES
100 0 100 200 300 400 Miles
Port Macquarie
Crowdy Head
Cape Everard
BASS STRAIT
Babel Island
Storm Bay
120°E
130°E
140°E
150°E

Fig. 2. Demersal fisheries of Australia

(*Metapenaeus and Penaeus spp.*)—obtained off the coasts of New South Wales and Queensland. Recently there has been a sharp increase in the catches of crayfish (*Jasus spp.*) around the coasts from Port Macquarie to Geraldton (*Fig.* 2). New demersal grounds have been located in the Great Australian Bight and off Western Australia, but, as yet, only the former has reached the exploratory stage of development.


120°E
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Darwin
Cairns
MAJOR GROUNDS
Spanish Mackerel – Coffs Harbour to Cairns
Barracouta – Bass Strait, East Tasmania
Jack Mackerel { E. Tasmania, southeast N.S.W. and W.A.
Tuna – N.S.W. and S.A.
Coffs Harbour
AUSTRALIA
PELAGIC FISHERIES
100 0 100 200 300 400 Miles
BASS STRAIT

Fig. 3. Major deep sea fishing grounds

Australia lacks detailed and accurate knowledge of its deep sea or pelagic fishery resources. Recent researches have led to the discovery of tuna, mackerel and other pelagic fisheries in nearby waters, and current surveys are helping to make known more fully the distribution and habits of surface feeding fish in several offshore locations. Much more work needs to be done in this direction, however, before the full extent and importance of the continent's fisheries of this type can be adequately assessed.

The pelagic fisheries developed so far are in the temperate coastal waters, principally near the four southeastern states, but to a limited extent also off southern Queensland and the southwest of Western Australia (*Fig.* 3).

Tunas, true mackerels and similar species, tailor (*Pomatomus pedica*) and yellowtail kingfish (*Seriola grandis*) are the most abundant pelagic fishes in Australian waters. The tunas, represented by the southern bluefin (*Thunnus tynnus maccoyi*), the northern bluefin (*Kishinoella tonggol*), the skipjack (*Katsuwanus pelamis*), the yellowfin (*Neothunnus macropterus*) and the dogtooth (*Gymnosarda nuda*), are obtained mainly from the waters off southern New South Wales and South Australia.

Riverine Fisheries

The Murray-Darling river system is Australia's only commercial inland fishery (*Fig.* 1), the output of which is wholly of teleostean fresh-water species. Callop (*Plectroplites ambiguus*), Murray cod (*Macculochella macquariensis*) and English perch (*Perca fluviatilis*), in that order, are the principal commercial fishes: the 1957-1958 production of Callop (1.3 million lb live weight) was double that of Murray cod and thirteen times that of English perch. Of these, the Murray cod (which is not a true cod but really a member of the perch family), is highly prized for its excellent food qualities.

Compared with the marine fisheries the yield of Australia's fresh-water fisheries is not only insignificant but the catches from them are also very irregular because even moderate fishing makes great inroads on the naturally low stocks of freshwater teleosts. In consequence, closures have to be applied to the inland fisheries far more frequently and for longer periods than is the case with the coastal fisheries.

Shell Fishing and Culture and Whaling

Apart from its general fisheries, Australia's marine enterprises consist of the catching of crustaceans, the gathering or culture of molluscs, the taking of pearl and trochus shell, and whaling. For the five-year period ending 30 June 1958 the Australian catch of crustaceans amounted to about twenty-five million lb. gross weight annually. Of this, more than eighty percent is usually provided by crayfish (*Jasus spp.* and *Panulirus longipes*) considerably more than half of it coming from Western Australia and smaller quantities from the southeastern states.

In prewar years prawning was confined to the coastal lakes and rivers in the east, but following the discovery of deep-sea prawns in Broken Bay and off the New South Wales coast in 1947 the industry has been extended widely into open waters.[7] About five million lb of prawns are now obtained annually, principally from New South Wales and Queensland which also produce small quantities of sand crabs (*Portunus pelagicus*) and mud crabs (*Scylla senata*) (Table II).

TABLE II

CRUSTACEANS AND MOLLUSCS: PRODUCTION BY TYPE IN AUSTRALIA*

Type	*1953-1954*	*1954-1955*	*1955-1956*	*1956-1957*	*1957-1958*
Crayfish	17,412	20,198	18,444	18,896	21,968
Prawns	4,303	6,648	6,148	5,075	4,687
Crabs	542	813	870	835	826
Total crustaceans**	22,265	27,668	25,474	24,815	27,504
Oysters	9,688	10,454	9,637	10,310	10,617
Scallops	3,779	5,406	5,988	7,074	4,219
Total molluscs***	13,570	15,931	15,708	17,490	14,972

* Crustaceans in thousands of pounds gross weight, molluscs in thousands of pounds shell weight.
** Includes shovel-nosed lobster (*Thenus orientalis*).
*** Includes squid and abalone (*Heliotis spp.*).

Source: *Statistical Bulletin: Fishing and Whaling Australia, No.* 4, 1957-1958, Comm. Bureau of Census and Statistics. Canberra, 1959.

About ten million lb (in shell weight) of oysters are obtained annually, principally from New South Wales where they are cultivated and from Queensland where they are gathered as natural resources. Scallops (especially *Notovola meridionalis*) are obtained commercially from Tasmania, and, since 1956, from Queensland.

The Sydney Rock Oyster (*Saxostrea commercialis*) which grows in profusion along the New South Wales coast is the major source of supply. The oysters are farmed on 'leases' rented from the Crown on mud or sand flats and rocky benches along the shores of the coastal lagoons and estuaries. Usually, the spat (young oysters) are caught on material known as cultch which has been set near the mouths of estuaries. After a catch of spat has been obtained, the cultch is usually removed to a point further from the estuary mouth where it remains for from six to twelve months before being taken to maturing grounds for another eighteen months to two years. In some instances, the oysters, especially the spat, are grown on strips of wire mesh supported by stakes a few inches above the mud. More commonly the oysters grow on platforms of mangrove sticks which are similarly elevated, or sometimes on rough-hewn blocks of soft sandstone arranged in rows. Mangrove is preferred to other wood because it resists the attacks of the teredo or marine borer (commonly known as the 'cobra') sufficiently long to allow the oysters to mature before it is riddled. The softer varieties of sandstone must be used for oyster

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[7] See W. J. Dakin: 'Adventure in Science and a Fishing Story of the Coastal Lakes of Eastern Australia', *Walkabout*, Vol. 14, No. 1, November 1947, pp. 29-34. The article describes the prawning researches which preceded the discovery of the deep-sea prawns.

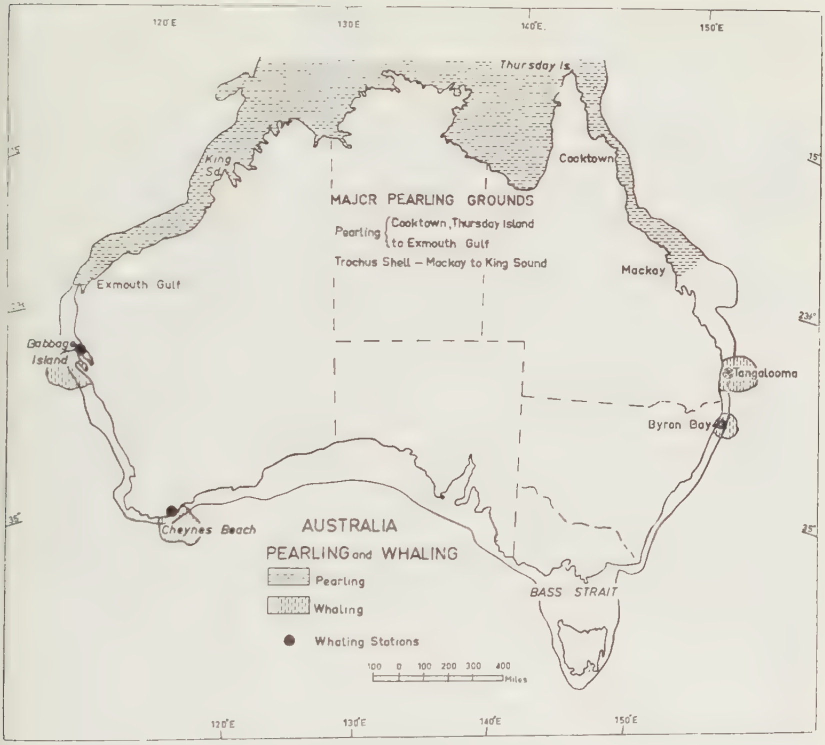

Fig. 4. Pearling and whaling grounds

culture, otherwise the mature oysters are cracked and broken when they are being removed.[8]

Pearl shell is fished from Cooktown and Thursday Island and round the northern coast to Exmouth in Western Australia, and trochus from Mackay round the north coast to King Sound in Western Australia (*Fig.* 4). The 1957-1958 production of shell amounted to a value of a little over £A one million (Table III).

TABLE III

PEARL SHELL AND TROCHUS SHELL IN AUSTRALIA: QUANTITY AND GROSS VALUE★

Particulars	*1953-1954*	*1954-1955*	*1955-1956*	*1956-1957*	*1957-1958*
Pearl Shell					
Weight★★	2,337	2,489	2,913	3,724	4,102
Gross value★★★	595	647	771	1,006	995
Trochus Shell					
Weight★★	3,057	2,784	2,114	1,911	1,229
Gross value★★★	260	350	346	357	184
Total value of shell	855	997	1,117	1,363	1,179

★ Excludes the following amounts of pearl shell taken by Japanese pearlers operating in Northern Territory waters: 1953-54, 2,110,000 lb; 1954-55, 2,105,000 lb; 1955-56, 1,657,000 lb; 1956-57, 1,458,000 lb; 1957-58, 1,572,000 lb.

★★ Thousand pounds.

★★★ Thousand £'s.

Source: Statistical Bulletin: Fishing and Whaling Australia, No. 4, 1957-1958, Comm. Bureau of Census and Statistics, Canberra, 1959.

From the outset, natural pearls in northern Australian waters have been collected almost wholly by Asian divers, notably Malays and Japanese, but also Chinese, Koepangers and Filipinos, and by some Papuans and Torres Strait islanders. Soon after federation, attempts were made to oust the Asians and other alien nationals from the industry in accordance with the 'white Australia' policy of the Immigration Restriction Act, 1901.[9] This action has had to be modified in order to arrest a decline in the industry because Australia lacks key men with the expert knowledge possessed by Japanese and other aliens, and because there is no local supply of skilled labour.

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[8] T. C. Roughley: 'Oyster Farming in Australia', *Walkabout* Vol. 3, No. 11, September 1937, pp. 12-16; T. Humphrey: 'The Biology and Cultivation of Oysters in Australia', *C.S.I.R. Fisheries Div., Report No. 10*, 1941.

In 1928, the Japanese produced the first spherical pearl from Australian mother of pearl oyster at Boeton Island in the Celebes, and their 'culture' activities spread later to Palao in the Pelew Islands, and Okinawa. The mother oysters were fished by Japanese divers in the Arafura Sea and transported up to 2,000 miles in vessels equipped with wells. In 1956 the Western Australian Government granted a lease of certain waters and land on the southeast coast of Augustus Island (about 200 miles north of Broome) for the establishment of a culture on a site selected by a Japanese specialist. More recently, the Commonwealth Scientific and Industrial Research Organisation has set up an experimental culture station on the west of Thursday Island.

Photo: Australian News and Information Bureau

Fig. 5. Maturing beds of young oysters on George's River, near Sydney. The stone breakwater restricts the force of the tidal flow thus reducing the risk of damage to the oysters

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[9] For a history of the pearling industry in northern Australian waters see: W. Savile-Kent, 'Fishes and Fisheries of Western Australia', *Western Australia Year Book 1893-4*, and 'Pearl Shell, Bêche-de-mer and Trochus Industry of Northern Australia', *Comm. Fisheries Office, Economic Report, No. 1*, Sydney, 1946, pp. 8-10.

Whaling stations operate from land bases at Babbage Island, near Carnarvon, and Cheynes Beach, near Albany, in Western Australia; at Tangalooma on Moreton Island in Queensland, and at Byron Bay in New South Wales (*Fig.* 4). The company operating at Byron Bay opened a second station at Norfolk Island in 1956, and a third in New Zealand in 1959.[10]

Production from whaling is restricted by the terms of the Australian Whaling Act. Whaling quotas are allotted to the companies each season. Thus, in 1959 the total catch was limited to 2,020 whales of which 1,120 whales were allocated to west coast fisheries (Nor' West Whaling Company 1,000; Cheynes Beach 120) and 750 whales to the east coast (Whale Industries, Tangalooma, 600; Norfolk Island and Byron Bay, 150).

Photo: Australian News and Information Bureau

Fig. 6. Oyster culture in wire trays at the Shell Point research station, George's River

Although about 24,000 persons and 11,000 boats were engaged in fishing and whaling in Australia in 1957-1958 the various enterprises accounted for only a small proportion of the national income from production, as shown for instance by the 1956-1957 figures (Table V), the latest year for which comparable figures are available.

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[10] For a description of land-based whaling activities in Australia see J. K. Ewers: 'Whaling at Point Cloates, W. A.', *Walkabout*, Vol. 2, No. 6, April, 1936, pp. 12-22; W. J. Dakin: 'Whaling and Australia', *Walkabout*, Vol. 12, No. 11, September 1946, pp. 4-12.

In terms of local values, fishing and whaling production first exceeded £A2 million in 1944-1945 with an output valued at £A2.2 million.

TABLE IV

WHALING STATISTICS, AUSTRALIA AND NORFOLK ISLAND, 1954-1958

Particulars	*Unit*	*1954*	*1955*	*1956*	*1957*	*1958*
Stations operating	Number	5	5	5	5	5
Chasers engaged	,,	9	10	10	11	12
Quota of whales*	,,	2,040	1,840	1,990	1,960	1,960
Whales taken and processed	,,	2,039	1,840	1,990	1,961	1,812
Whale oil produced	**					
Quantity	Barrels	100,068	95,258	102,366	102,966	97,698
Value	£'000	1,668	1,667	1,835	1,820	1,424
Value of by-products (meal, solubles, baleen)	,,	292	286	398	385	442

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* In terms of humpback whales, as determined by the Minister for Primary Industry. For quota purposes, 1 blue whale is taken as equivalent to 2 fin, $2\frac{1}{2}$ humpback, 6 sei or 6 bryde whales.

** 6 barrels = 1 ton.

Source: Commonwealth Fisheries Office.

It then expanded slowly to a peak figure of £A11.7 million in 1957-1958. Despite this fivefold increase in the postwar years the value of fishing and whaling remains insignificant by comparison with other major economic activities in Australia. Since 1944-1945 fishing and whaling have contributed annually only about 0.3 percent of the total national income from production.

FISHERY PROBLEMS

There are many reasons for the low economic status, the slow tempo of development and the relative instability of fishing and whaling in

Australia. The industry is handicapped most seriously by the physical nature of the Australian fisheries, though several contributory factors are also important.

As in all southern hemisphere countries except South Africa and possibly Peru, the seas around Australia lack large stocks of fish although their marine fauna is abundant and varied. The small extent of continental shelf around much of Australia and the low fertility of the southern oceans are the principal reasons for the meagreness of the fishery resource.

TABLE V

PRODUCTION OF FACTORIES AND PRIMARY INDUSTRIES: AUSTRALIA 1956-1957

	Net Value of Recorded Production (£A'000)	*Net Value of Recorded Production per head of mean population* £	s.	d.
Factories	1,622,700	170	3	8
Pastoral	598,663	62	15	8
Agriculture	254,861	26	14	7
Dairying	141,211	14	16	2
Mining and Quarrying	139,977	14	13	8
Forestry*	51,117	5	7	3
Poultry	28,402	2	19	7
Fishing and Whaling*	10,563	1	2	2
Trapping*	6,013	–	12	7
Bee-farming*	2,254	–	4	9
TOTAL	2,855,761	299	10	1

Note: Depreciation and certain maintenance costs have not been deducted.

* Local values (the gross production, valued at the place of production); these are obtained by deducting marketing costs from the gross value. Marketing costs include freight, costs of containers, commission and other charges incidental thereto.

Source: Commonwealth Year Book No. 44 (In preparation).

The only large area of shallow waters is in the tropical north where the Sahul Shelf spreads widely beneath the Timor and Arafura Seas. Unfortunately there are few people in this part of the continent and, except for pearling, opportunities for developing commercial fisheries are very limited.

In contrast to the North Pacific and North Atlantic the Australian seas have no large fish breeding and feeding grounds teeming with phytoplankton and zooplankton. Not only are the southern hemisphere waters generally believed to be less fertile than those of the northern hemisphere,[11] but there appear to be no large upswellings of cold water around Australia to bring cold-water plankton into the warmer seas. Moreover, as the only large area of continental shelf lies in the tropical north, the waters there are more saline than those usually preferred by plankton.

In some years fishing operations have to be suspended for quite long periods because of cyclonic disturbances around the Australian coasts. Thus, in July 1959 fishing vessels had to remain continuously in New South Wales ports for three weeks because of very high seas. Even longer periods of inactivity are not uncommon. The hampering effects of storms on fishing activities are perhaps much stronger in Australia than in most commercial fishery regions because so many of the fishing boats are small craft which can operate for only relatively short distances from their coastal bases.

Quite apart from these physical disadvantages of the marine environment the development of the continent's fisheries has been retarded by economic and social handicaps. Judged by northern hemisphere standards Australians generally do not eat much fish. In the year 1957-1958 the Australian consumption of meat was 200 lb per person compared with only 9.8 lb of fish. Thus, in contrast to a country like Japan, the dietary needs of the people do not exert a pressure on fishery resources. Furthermore, although some fifteen to twenty million lb of fish is imported regularly each year from overseas because local sources cannot satisfy the demand, that demand is not great enough to encourage the investment of large amounts of capital in the local industry.

On occasions, the Australian fishing industry has been embarrassed by alternating gluts and famines resulting from the 'patchiness' of the fish runs and the over exploitation of some species and the under exploitation of others. Large schools of edible species may appear in one year and then only in small numbers for several years thereafter.

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[11] That is, the seas do not have high concentrations of phosphatic and other elements necessary for the large-scale propagation of plankton. See W. J. Dakin and A. N. Colefax: 'The Marine Plankton of the Coastal Waters of New South Wales', *Proc. Linn. Soc. N.S.W.* Vol. 58, No. 3, 1933, pp. 186-222; 'Observations on the Seasonal Changes in Temperatures, Salinity, Phosphates, and Nitrates, Nitrogen and Oxygen of the Ocean Waters, on the Continental Shelf of New South Wales and the Relationship to Plankton Production', *ibid*, vol. 60, No. 5, 1935, pp. 303-14.

Fig. 7. Fishing fleet in Ulladulla Harbour, New South Wales. In common with many of the small fishing ports which have grown up on sheltered inlets, Ulladulla has its fisherman's co-operative which provides facilities for the handling, storage and marketing of the catch

The gluts cause a serious wastage of fish because of inadequate storage facilities on the boats and a deficiency of shore installations capable of handling large stocks. The majority of fish canners and processers are relatively small operators who lack the capital necessary for the installation of large processing plants. In any case, the uneven supply of fish in most Australian fishing regions would make large plants uneconomic.

The irregular supplies, the lack of varieties and the mediocre or poor quality of much of the fish marketed have not helped the Australian public to acquire a strong liking for fish. The effects have been particularly marked in the inland towns where the consumers have usually been given little or no choice in the kinds of fish offered for sale: commonly the range of supplies is limited to less palatable species. Furthermore, the fish fillets, often much deteriorated in quality through faulty handling and alternate freezing and partial thawing, frequently have a soggy and unsavoury appearance, and at times a strong 'fishy' smell before they reach the buyer.

The lack of precise knowledge concerning the nature and extent of the fishery resources has seriously impeded the development of the Australian fishing industry. The recent discovery of new prawning

Photos: Australian News and Information Bureau

Fig. 8. Fish cannery at Cattle Bay, Eden, New South Wales. Canneries are a fairly recent development in Australia, their establishment following the exploitation of the pelagic fisheries, notably of tuna and Australian salmon

grounds and new demersal and tuna and other pelagic fisheries, and current fisheries research are filling in some of the gaps, though this body of knowledge is still very imperfect.

Problems exist also on the production side. Many of Australia's fishermen are postwar recruits to the industry, and lack the skill backed by long experience which is so strongly a feature of the northern hemisphere fisheries. With some exceptions, general utility craft are employed for there are few boats designed specifically for specialised branches of the industry like tuna catching. Since many of the fishermen are small operators they are unable to fit their vessels with the more modern equipment in common use elsewhere.

Many attempts have been made, particularly by governmental authorities during the postwar years, to combat the problems confronting the Australian fishing industry, and the recent expansion of production reflects the degree of success achieved. Each state legislates for the control of its own marine and freshwater fisheries and the commonwealth and state authorities cooperate in the conducting of fishery surveys and in other branches of fishery research. Especially valuable research on the fish and fisheries has been carried out by the

C.S.I.R.O. which maintains oceanographic and marine biology research stations, as at Cronulla, near Sydney and at Dunwich in Queensland, and a pearl fishery research station on Thursday Island. The investigations have covered such matters as plankton, the habits and movements of certain fish species, the 'spotting' of schools of fish from the air, experimenting with new techniques aimed at developing better methods for handling, storing and preserving fish after capture, and the investigation of diseases in fish and oysters.[12] All this has a significant bearing on the future of the fishing industry.

Moreover, under the provisions of a recent federal Act[13] the Commonwealth Government sold its Australian Whaling Commission enterprise at Babbage Island, near Carnarvon in Western Australia, to the Nor' West Whaling Company (the operators of a station at Point Cloates) and set aside the proceeds of £A800,000, as a trust account for financing fisheries research and development.

Prospects

Although fishing has expanded considerably during the postwar years the industry is not likely to hold more than a minor place in the Australian economy. Recent changes and developments in fishing and whaling suggest, however, that the upward trend in the output and value of fish and allied products might well be continued. Nevertheless, although Australia's marine resources are now known to be substantially greater than was formerly believed they are far from being limitless or even abundant.

Fisheries research is serving a twofold purpose, for, in addition to the opening up of new grounds, like the prawn and crayfish beds off eastern and western Australia respectively, experimental trawling operations, as in the demersal fisheries of the Great Australian Bight, are providing useful information concerning the types of vessels, gear and equipment necessary for satisfactory results.

Fishing developments, comparable with those of the last few years,

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[12] See for example: E. J. Ferguson, 'Some Notes on the Smoking of Fish', *C.S.I.R. Fisheries Div., Circ. No. 1*, Melbourne, 1940; *idem:* 'The Canning of Fish and Fish Products in Australia', *ibid., No. 2*, 1940; C.S.I.R. Div. of Food Preservation & Transport: 'Notes on the Application of Refrigeration to the Australian Fishing Industry', *Circ. No. 4 P*, Melbourne, 1942; M. Blackburn: 'The Economic Biology of some Australian Clupeoid Fish' *C.S.I.R. Fisheries Div. Rept. No. 6*, Melbourne, 1941; G. P. Whitley: 'Poisonous and Harmful Fishes', *ibid., No. 10*, 1943; M. Blackburn: 'Life History of the Australian Pilchard', *ibid., No. 12*, 1949; K. Sheard: 'Plankton Characteristics at Cronulla, N.S.W., 1943-46', *ibid., No. 17*, 1949.

[13] The Whaling Industry Repeal Act 1956 which revoked the Whaling Industry Act 1949 (the enabling act for the setting up of the whaling commission).

Fig. 9. Pearling lugger near Broome, Western Australia, manned by a predominantly Asian crew

Photo: Australian News and Information Bureau

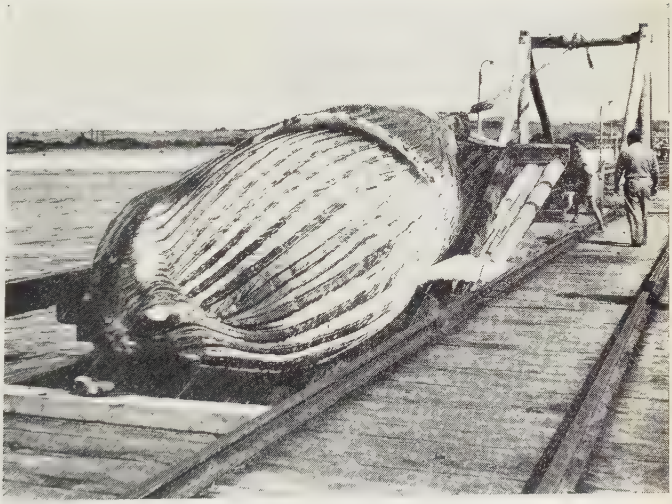

Fig. 10. Land-based whaling at Byron Bay, northern New South Wales. The whale, taken by a chaser, is being hauled on to a loader for transport to the processing plant

Photos: 'Northern Star', Lismore

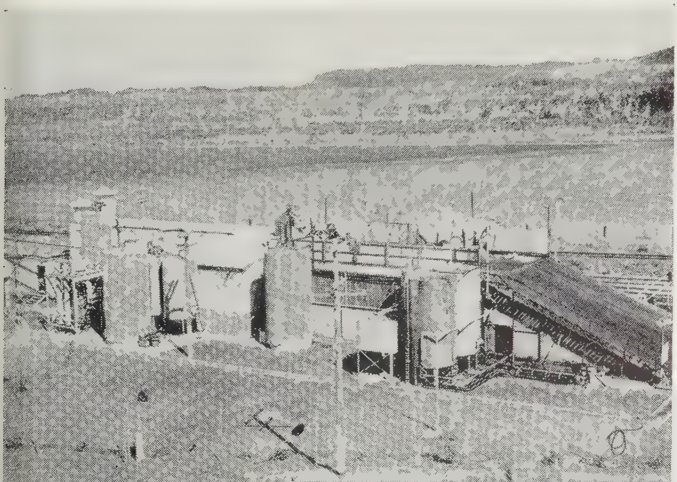

Fig. 11. The flensing deck and reduction plant at the Byron Bay whaling station could well be the outcome of new fishery surveys in the future. For instance, the presence of Japanese tuna fishermen in the Indian Ocean west of Australia in 1959 suggests that fishing potentialities may also exist in these waters. Here, an offshoot of the cold West Wind Drift flows northwards off Western Australia, thus resembling the Benguela Current off Southwest Africa and the Humboldt Current near Chile and Peru: it is possible that it could be associated with an upwelling of cold water like that which gives rise to the South African maasbanker-pilchard and Peruvian tuna fisheries.

Expansion of the fishing industry has been accompanied by improvements in the methods and equipment used by fishermen. Most of the boats used are small general purpose craft, but specialised vessels suitable for different kinds of fishing operations are becoming more common. Australian fishermen are now beginning to pay more attention to the need for up-to-date equipment—echo-sounders, special nets for different kinds of fish, more modern and efficient handling gear—and to the provision of better storage facilities on their vessels.

During the past few years the demand for fish in Australia has increased and a small export trade in marine foods such as prawns and crayfish has been developed with the United States. The post-war immigration of many European peoples with strong fish-eating habits has been one factor in the increased local demand, particularly in the big cities where the distribution of fish is better organised. The effect of this trend is indicated to some extent by the high prices now being paid in Sydney and its suburbs for small shops specialising in the sale of fish and marine foods; since 1957 the demand for this type of business has exceeded that for all others, and the transfer prices have been much higher. A recent series of sharp increases in the price of beef on the Australian market has probably helped to expand the local demand for fish.

Australia has fair prospects for improving its modest export trade in marine foodstuffs. Provided that exporters pay due regard to the price, quality and grading of their products the American markets should be capable of absorbing substantially larger quantities of Australian prawns and crayfish. But in developing this trade, and the export of tuna which has been suggested in some quarters, Australian fishermen will continue to meet strong competition from low-cost producers like Japan for crayfish, Mexico and the Philippine Islands for prawns, and Peru for tuna.

At present, pearling, the pearl and trochus shell industries and whaling are Australia's least-favoured marine enterprises. Respectively, they have been affected adversely by the development of pearl culture by Japan, by competition from plastics in the manufacture of buttons and ornaments, and by falling prices for whale oil. In an attempt to offset these trends Australia has begun the experimental culture of pearl oysters, is exploring possible new uses and markets for pearl and trochus shell, and has improved the efficiency of its whale-processing methods. The latter aims at the maximum possible reduction of oil, supplemented by the output of valuable byproducts like meal, solubles and baleen.

Thus, with a few minor exceptions, the general picture of Australian fishing industries provides reasonable grounds for optimism. Invigorated by their progress in the post-war years and nurtured by a benevolent administration they are making headway. The existing condition of the industries and the developments within them augur well for their greater stability and steady, even if unspectacular, advance in the future.

Endnote: When the manuscript of this paper was being prepared an Australian Press item announced (6 July 1960) that the Ross Group Ltd., of Grimsby, one of the world's largest fishing organisations, had bought the interests of International Fisheries of West Perth, W.A., for a large undisclosed sum. The company is to embark on an extensive expansion programme and will immediately spend £A75,000 on extending and modernising plant. It will increase considerably the export of crayfish to the United States, and hopes to increase the 1959-1960 figure of £A250,000 for exports to not less than £A500,000.

THE AGE OF THE AUCKLAND VOLCANOES

E. J. SEARLE

IT WAS APPARENT to early students of the geology of the Auckland area that all its volcanic features were very youthful. Cones were little modified by erosion; the solid basalt of flows was little weathered; even susceptible minerals, like olivine, were everywhere quite fresh; and, except where mantled with ash, the lava flows had very little soil cover. In consequence all writers attributed a Recent or sub-Recent age to volcanic activity in the field.

One of the first attempts to fix more exactly the time of eruption of one of the volcanoes was made by Goodall in 1875.[1] Excavations in Coburg (now Kitchener) Street near the present public library, laid bare the stump of a tree buried beneath twenty-five feet of volcanic debris erupted by the Albert Park volcano. Marks on the stump were interpreted by Goodall as having been made by axes and he was thus led to postulate that the volcano had erupted at some time after the arrival of the Maori about A.D. 1,000. Unfortunately the material on which he based his deductions was not preserved and his observations cannot now be checked. However, physiographic and other evidence make it quite clear that the Albert Park volcano was one of the oldest in the Auckland field and must have erupted long before the advent of the first human inhabitants. If the marks were indeed of axes then it must be assumed that the stump was buried by slumped debris and not by subaerial deposits following an explosive eruption.

An estimate that indicated a much greater age for a local volcano was advanced by Turner and Bartrum[2] for the Shoal Bay volcanoes. They originally believed that the eruptions at Onepoto and at other centres near Takapuna antedated the formation of the forty to sixty-foot terrace, prominent near the city, which is now believed to have been formed in Tyrrhenian times before the onset of the last glaciation. Later, however, Bartrum recognised that the evidence on which they had established the relationship of volcanic deposits to the terrace was quite unsatisfactory, and accepted that the volcanoes were younger than the terrace.[3] Likewise, Firth[4] presented evidence that eruptions at both Panmure Basin and at Pukaki Lagoon, Papatoetoe, occurred before the formation of a similar terrace surface developed in the south of the district. But again, later investigations have shown that in these cases, also, the dating must be regarded as faulty.[5] Wong concluded that 'the Auckland volcanoes erupted synchronously and furthermore at a period preceding the major final uplift of the Auckland Province', that is before the fall in sea-level that accompanied the last glaciation. In this he was clearly in error on both counts for, far from erupting synchronously, volcanic outbursts from different centres were separated by considerable intervals of time, and few, if any, of the volcanoes could have erupted before the onset of the last glacial epoch.

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[1] J. Goodall: 'On the Discovery of a Cut Stump of a Tree Giving Evidence of Man in New Zealand at or before the Volcanic Era', *Trans. N.Z. Inst.*, Vol. 7, 1875, pp. 144-146.

[2] F. J. Turner and J. A. Bartrum: 'The Geology of the Takapuna-Silverdale District, Waitemata County, Auckland', *ibid.*, Vol. 59, 1929, pp. 864-902.

Radiocarbon Dating

The introduction of radiocarbon dating has provided a more precise tool for determining the ages of volcanoes. Although it has been applied to material from only a small number of centres, the wood, charcoal and shells associated with volcanic deposits point to the extreme youth of some of the Auckland volcanoes and have given a clearer picture of the period of time during which there was volcanic activity in the Auckland field. Radiocarbon dating has a range of about 40,000 years and while this has not proved adequate to determine the age of the older centres of eruption it will no doubt suffice for a large number. In any case, the establishment of a *minimum* age for those volcanoes beyond the range of radiocarbon dating is more precise than could be determined by other available methods. Results to hand indicate that one volcano has been active within historic times, others within the range covered by radiocarbon dating, and others again erupted in times too remote to be defined by these methods.

On physiographic evidence Rangitoto appears to be one of the youngest volcanoes in the whole field. It has been shown to have been active in A.D. 1188 ± 50 years. It is not clear whether this date is, in fact, that of initial activity at the centre, as suggested by Brothers and

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[3] See P. Wong: 'Some Aspects of Post-Tertiary Vulcanism at Auckland', Unpublished M.Sc. Thesis in Geology, University of Auckland, 1946.

[4] C. W. Firth: 'Geology of the Northwest Portion of Manukau County, Auckland', *Trans. N.Z. Inst.*, Vol. 61, 1930, pp. 85-157.

[5] E. J. Searle: 'Volcanoes of the Otahuhu-Manurewa District, Auckland', *in press*.

Golson,[6] or whether it applies to explosive eruptions associated with recrudescence of activity at a later stage in the history of the volcano. The physiography of the cone suggests that the present summit was constructed by fire-fountaining activity following an explosive phase which destroyed the previously existing summit. Hence it may be that the ash whose age was established by these authors was produced at some such late stage in the volcanic history and that initial eruptions were much earlier. On the other hand, if the events dated were indeed those associated with the opening of activity at the centre, then the eruptions which formed the summit and produced great floods of basalt could have occurred at a time much closer to the present day. This would be in accord with the views of some local botanists who are convinced that the vegetation is very young—probably not more than 150 years old. Shell material from silts toed up and baked by these late lava flows at present awaits radiocarbon dating. This should date the latest eruptive events on the island, for the flow is not ash covered and must therefore be younger than the explosive ash-producing eruptions.

The maximum age of lava in the main flow from the volcano at Mount Wellington has been established by Ferguson and Rafter as 9150 ± 80 years before present.[7] This was the age of timber obtained from beneath the lava flows during drilling operations at the bridge over the motorway at Penrose. A sample of charcoal enclosed in lava, from a specimen in the museum of the Department of Geology, University of Auckland was labelled 'Penrose, Mt. Smart flow'. The age of the carbon was determined as 9,100 ± 160 years old. The exact locality from which this latter specimen was collected was not recorded and consequently, the volcanic source recorded on the label must be regarded with suspicion.

The lavas of Mount Wellington and Mount Smart adjoin and field evidence shows clearly that those of Mount Smart were emplaced before those of Mount Wellington were poured out. Near Penrose, the Mount Smart flows underlie the Mount Wellington flows and baked swamp silts squeezed up by the latter flows suggest that sufficient time elapsed between the two effusions for swamp deposits to accumulate in the dammed valley head now occupied by the Mount Wellington flows—an interval possibly longer than the maximum tolerance of 190 years accordant with the two datings. The possibility that both samples were from the same flows cannot be excluded. Samples of wood definitely contained by lavas from Mount Wellington are awaiting processing; determination of their age will resolve the present confusion.

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[6] R. N. Brothers and J. Golson: 'Geological and Archaeological Interpretation of a Section in Rangitoto Ash on Motutapu Island, Auckland', *N.Z. Journ. Geol. Geophys.* Vol. 2, 1959, pp. 569-577.

[7] G. J. Ferguson and T. A. Rafter: 'New Zealand ^{14}C Age Measurements', *N.Z. Journ. Sci. & Tech.*, Vol. 36B, 1954, pp. 363-374.

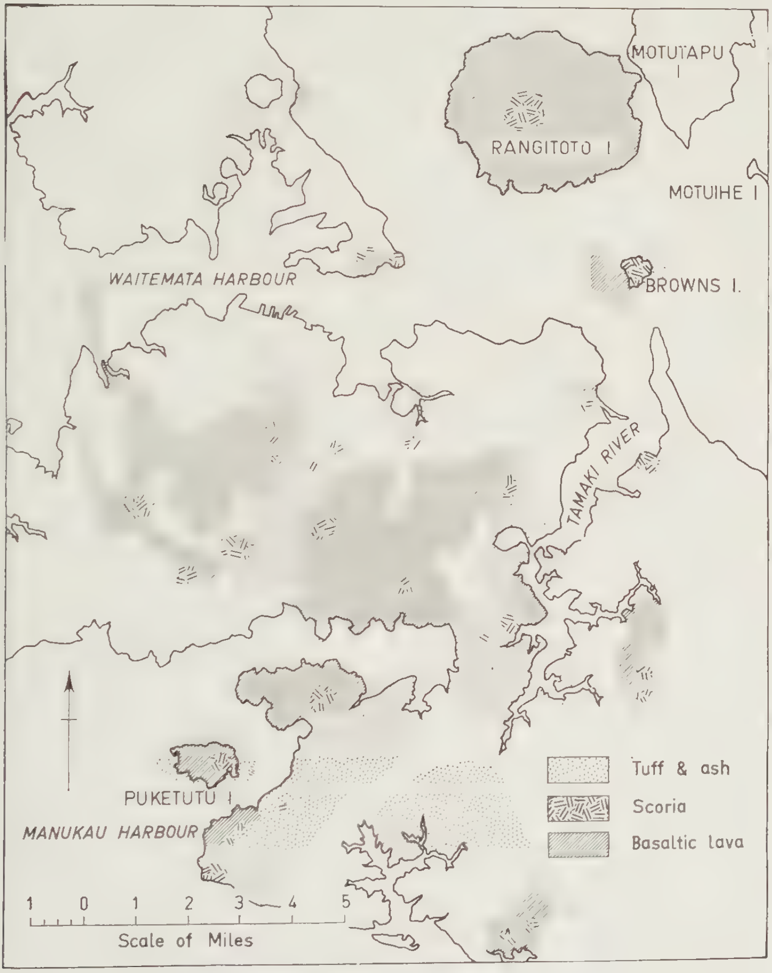

Fig. 1. Volcanic rocks in the Auckland area

Meanwhile it is clear that at least one volcano in the Penrose area was active less than 10,000 years ago. The similar preservation of form and extent of weathering and soil cover shown by both scoria deposits and basalt flows originating from other centres suggests that other volcanoes in the Auckland field are of comparable age.

Many years ago timber was obtained from excavations in thick tuff at Woodside Road, Mount Eden. This has now been found to be 21,000 ± 800 years old. Again, the precise centre from which the covering tuff was erupted is not known. The site of the excavation is reasonably close to a number of explosive centres, especially to those of the Three Kings group and also to the complex, ill-defined tuff rings clustered in the area between Mount Eden and Three Kings. Certainly some of these vents must have been responsible for burying the timber and therefore have been in eruption approximately 21,000 years ago. Whatever its origin the tuff body is covered nearby by lavas poured out from the volcano of Mount Eden. Hence the timber establishes a maximum age for Mount Eden although, of course, it may be very much younger. The general appearance of the scoria cone and the character of the surface of the flows suggests that they are at least as old as those of Mount Wellington, so that an estimated age of 10,000 to 20,000 years for Mount Eden would seem to be reasonable.

Lava Flows and Tuff Explosions

Field evidence shows that Mount Albert was active before Mount Eden erupted, for lava flows from Mount Eden have covered and been diverted by those of Mount Albert. Wood obtained from beneath flows from Mount Albert has been shown to be not younger than 30,000 years old. If the timber represents trees in growth which were overwhelmed by the basalt then it follows that activity at Mount Albert must also have occurred more than 30,000 years ago.

More precisely dated are the tuff explosions that developed wide tuff craters and spread a considerable blanket of ash over the Ihumatao district. On the shores of Manukau Harbour, close to the foot of the scoria cone, Maungataketake (Ellett's Mountain), there is exposed a dense kauri forest killed and buried by the showers of tuff. Trees of great size, some more than thirty feet in girth, litter the shore platform and their stumps stand up through the eroded tuff. Wood of a small sapling in position of growth has been shown to be 29,000 ± 1,500 years old. This fixes definitely the time of explosive eruptions in Ihumatao. The lavas of Maungataketake overlie the tuff and must therefore be younger, though probably not appreciably younger for it is highly likely that fountaining and effusion of lava followed quickly on the explosive phase. The tuff body, erupted from a number of explosion craters, is continuous and the scoria cones of Otuataua and Pukeiti, and their small lava fields appear to be superimposed upon it. The bedded tuffs of the great explosion crater of Waitomokia pass under the lavas of Pukeiti at Ourangi bridge, and although their relationship to the Ihumatao tuff is not clear it is probably not very different in age.

Minimum ages are also available for the Takapuna volcanoes. Wood and kauri gum from beneath basalt flows from the Pupuke volcano have proved to be more than 42,000 years old and this dating has been confirmed from charred logs in pyroclastic debris of a quarry in Tauhoroto Road. On geomorphic grounds it is difficult to accept the age of these centres as being as great as this, but the evidence is too strong to be denied. Subject to confirmation from a further specimen awaiting processing it must be assumed that activity in the Shoal Bay area dates back more than 40,000 years.

Lastly, at the Tamaki bridge, Panmure, the wood of trees in position of growth, with roots established in Pleistocene silts, is known to be 28,000 ± 1,000 years old. The remains of small trees crowd a flat-lying bed that may be followed for a considerable distance along both sides of Tamaki inlet close to high tide mark. In several localities they are buried under bedded tuffs of the Panmure Basin tuff ring. The manner in which the tuff covers the stumps and recumbent limbs of the trees accords with the view that the trees were growing at the time of burial so that the time of eruption must be very close to that given for the age of the timber. While it is rather surprising to find such a great time interval between the eruption at Panmure Basin and that at the neighbouring centres of Mount Wellington, confirmation is provided by the pungas and other vegetation exposed in drainage tunnels which clearly show that an earlier tuff (presumably from Panmure Basin) was eroded and clothed with vegetation before being covered by the products of later explosive eruptions.

No further ages on an absolute scale are available as yet but recent physiographic evidence has strengthened the conviction that the great majority of centres have erupted since the onset of the last glaciation. Nor has any evidence come to light that would point to any vent being active before that time. Several types of evidence support these contentions.

The larger lava flows from volcanoes on the isthmus occupy valleys which, in their seaward portions at least, are cut to base levels well below that of the present sea level regime. The active downcutting of these valleys was almost certainly achieved during glacial times when sea level was lowered to perhaps 300 feet below that of today. The flows from Mount Eden that ultimately form the Black Reef in Waitemata Harbour provide a typical example of what is generally found. Drilling by the Auckland Harbour Board near the seaward extremity of the reef shows that the basalt surface is approximately forty feet below mean sea level and that the basalt is about ten feet thick and rests upon Pleistocene silts.

Physiographic Evidence

Extensive prickings in the area show that the young silts are contained in a wide valley carved in rocks of the Waitemata formation. Apparently the lavas invaded a youthful valley incised in the Pleistocene sedimentary rocks and presumably carved during the last glaciation. Similarly, lavas originating from vents on Browns Island (Motukorea) flowed first to the west down the right flank of the deepened valley of the ancestral Tamaki Stream, and then spread north and south along the line of the valley. At the deepest part of the old valley, the flow is thirty feet thick and its base is at a depth of fifty feet below sea level; the basalt rests on silts filling the bottom of the ancient valley, the floor of which at this point is approximately 100 feet below mean sea level.

None of the flows occupying these overdeepened valleys shows any evidence of marine erosion attributable to earlier glacial cycles—no evidence of benching at forty to sixty feet or at twenty feet above modern sea level, or at thirty feet below sea level—as is found on the sedimentary terrain. On the contrary, volcanic products generally mantle such surfaces on the sedimentary terrain where they are in the neighbourhood of centres of eruption.

In none of the flows now covered by the sea is there any evidence of explosive, spatter or destructive events such as might be expected if lavas had entered the sea in a hot or molten state. On the other hand, it must be admitted that the flows of Rangitoto (which must certainly have been in eruption when sea levels were much as they are now) also show no obvious sign of the entry of live lava into the sea apart from the baking of marine muds squeezed up the lavas. In none of the other flows now below sea level have similar baked recent sediments been observed.

Phreatic and magmato-phreatic volcanoes whose tuff cones now rise from the sea bed do not appear to have erupted as submarine volcanoes. At Panmure Basin, Onepoto Basin, and at Ihumatao, debris from these volcanoes has buried standing trees established on surfaces now below high water mark. In all cases the forests contained trees of very large size. Such forests could not have been growing for at least 5,000 years, for over the whole of that time sea levels have been at least as high as they are today and the land surfaces must have been below high water level. It is suggested that these areas were forested during times when sea levels were low in response to the last glaciation and that eruptions occurred while levels were still low. The dates provided by samples at Tamaki and Ihumatao confirm this supposition for the centres in these districts.

Neither the basalts of flows nor the fragmental materials exhibit any degree of advanced weathering, whilst constructional landforms have been little affected by erosion. It is difficult to imagine that they could have been so little scarred had they withstood a longer period of time than that covering the last glaciation.

The Likely Time Span

The absolute ages so far established show a span of volcanic activity in the Auckland field extending over more than 42,000 years. It has been shown, too, that while maximum limits to the period of vulcanicity cannot be fixed with any degree of precision, it does not appear to have extended back beyond the last glacial epoch. Certainly, activity was in progress during the period of intense glaciation and continued during the subsequent period of ameliorating conditions that accompanied the start of ice retreat for which Charlesworth accepts 30,000 to 35,000 years ago as 'a not improbable time'.[8] The last glaciation itself probably had its onset as far back as 100,000 years ago,[9] and this could reasonably be regarded as the extreme limit for local vulcanicity. Possibly a realistic estimate of the span during which there was intermittent activity would be of the order of 60,000 to 70,000 years. During that period eruptions have occurred from at least 50 centres in the Auckland area. As the last volcano erupted less than 1000 years ago, the possibility that vulcanicity in this field has ceased must be considered to be very remote indeed. Further eruptions may be expected to occur in the Auckland area.

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[8] J. K. Charlesworth: *The Quaternary Era*, London, 1957, p. 1517.

[9] R. F. Flint: *Glacial Geology and the Pleistocene Epoch*, New York, 1947, p. 532.

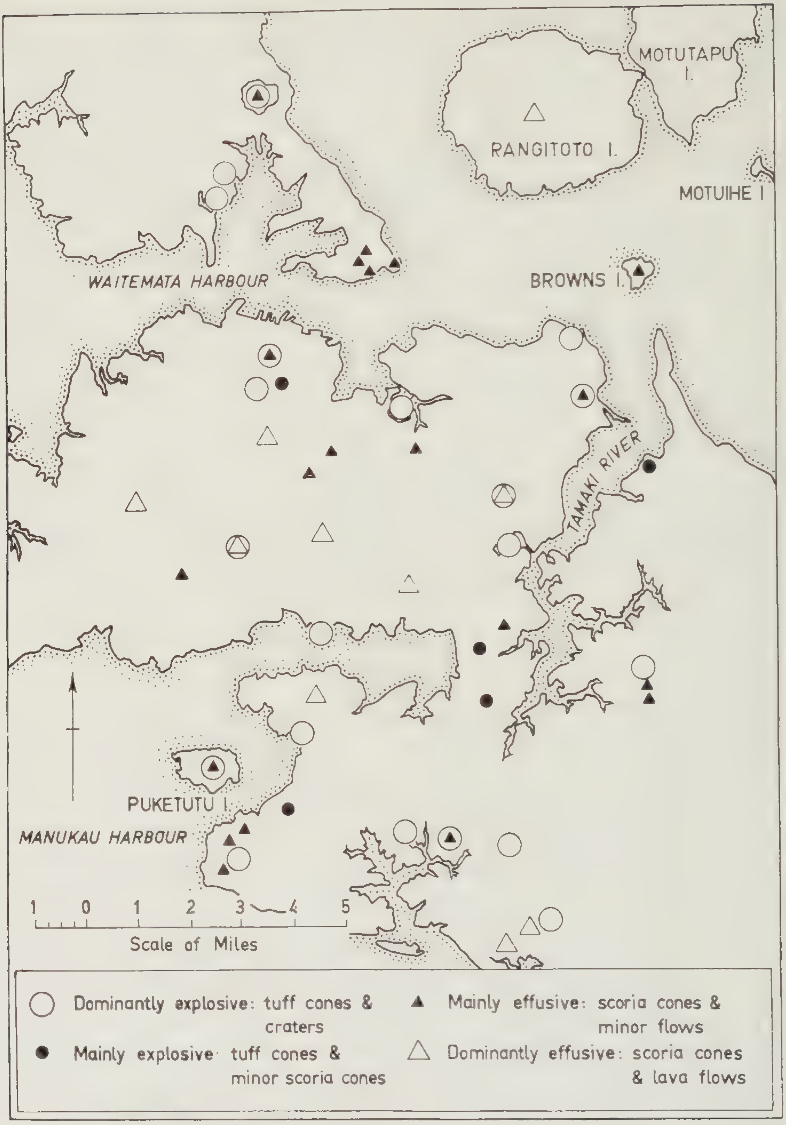
MOTUTAPU I.
RANGITOTO I.
MOTUIHE I
WAITEMATA HARBOUR
BROWNS I.
TAMAKI RIVER
PUKETUTU I.
MANUKAU HARBOUR
1 0 1 2 3 4 5
Scale of Miles
○ Dominantly explosive: tuff cones & craters
● Mainly explosive: tuff cones & minor scoria cones
▲ Mainly effusive: scoria cones & minor flows
△ Dominantly effusive: scoria cones & lava flows

Fig. 2. Auckland volcanoes classified according to mode of origin

There are, however, no surface indications of continuing activity in the district. Solfataric processes are nowhere evident but these seem never to have been important accompaniments of activity in any of the Auckland volcanoes, for nowhere are there signs of ancient solfataras. Nor is there any reliably-validated record of hot springs in the district. It is true that in recent years there have been reports of high ground

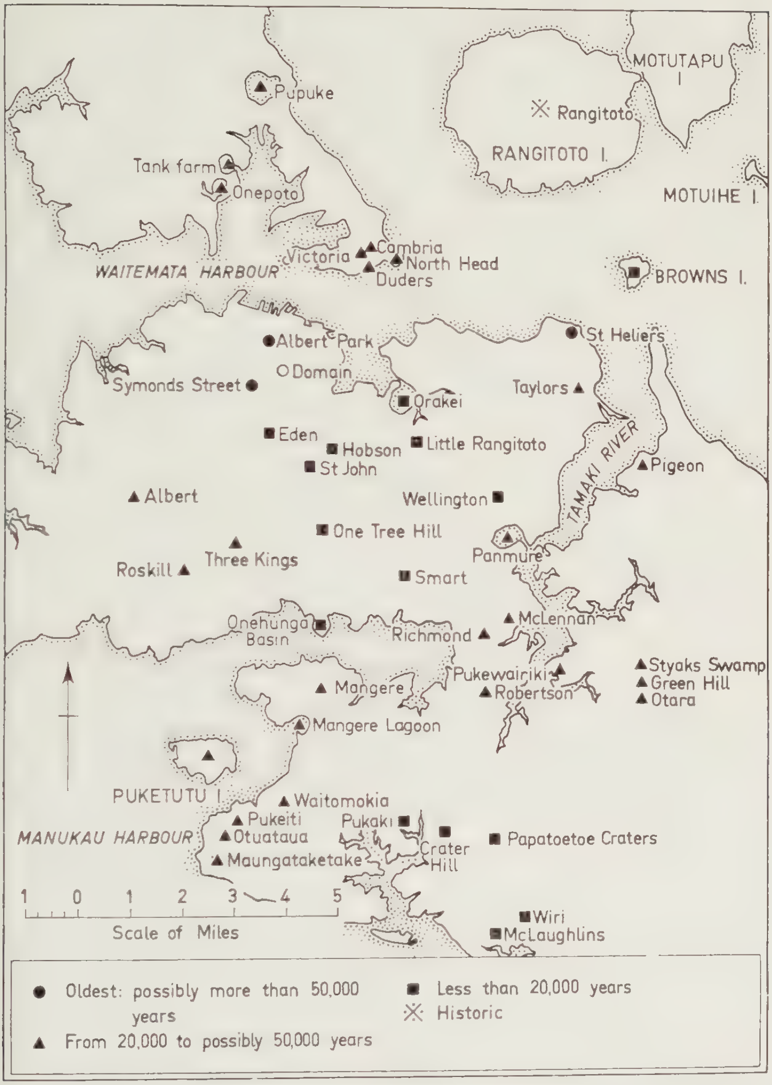

Fig. 3. Auckland volcanoes classified according to age

temperature from two localities but these do not appear to have derived their heat from volcanic sources. One has been shown to be due to organic material buried in cavernous basalt; the other is close to a large treatment plant at Newmarket where a considerable quantity of hot water is discharged through a sump into cavernous basalt of a flow emanating from Mount Eden.

In the following list an attempt has been made to classify the Auckland volcanoes on a basis of age. The criteria of classification apart from radiocarbon dating remain rather vague but it is doubtful if a much more accurate catalogue could be devised with the data as yet available.

(I) *Oldest Volcanoes*—These are probably older than 50,000 years and are so classed because of the degree of weathering shown by their volcanic materials and of the extent to which constructional forms have been modified by erosion. This group would include:—

(1) The Albert Park volcano, originally a scoria cone within or surmounting a tuff ring. A small lava flow extended only a few hundred yards in the vicinity of Victoria Street. The scoria cone was probably centred on a vent near the Magistrate's Court. Drilling at the proposed municipal carpark near Victoria Street showed volcanic materials to a depth of eighty feet below present sea level but did not make clear whether this was filling in a crateral hollow or in an ancient valley. The former explanation appeals as the more probable. (2) The tuff cone at the top of Symonds Street. The centre of eruption was probably located near the site of the municipal reservoirs. There is now no indication of the explosive crater or, indeed, of any clearly defined tuff ring. The original site of eruption is indicated only by the distribution pattern of volcanic debris and its known thickness and grade in different localities. (3) The Domain group. Here a cluster of small volcanoes has constructed a complex landform dominated by a wide explosion crater with associated scoria mounds. Only minor lava flows were formed. (4) St. Heliers volcano probably belongs here. It was the centre of explosive eruptions that piled up a ring of tuff about a crater on top of the seacliffs east of St. Heliers Bay.

(II) *Older Volcanoes*—These include those volcanoes with well preserved constructional forms but whose ages as established by ^{14}C dating are greater than 20,000 years and others whose appearance is comparable with those so dated:—

(5) The North Shore group: Victoria, Cambria and North Head at Devonport and Pupuke, Onepoto and Tank Farm at Takapuna; (6) Panmure Basin and the Otahuhu group; (7) Mount Albert, Three Kings, Mount Roskill; (8) Pukewairiki in Tamaki inlet; (9) The Papatoetoe craters; (10) The Mangere-Ihumatao group.

III. *Younger Volcanoes*—These are less than 20,000 years old:—

(11) Mounts Wellington and Smart; (12) The Manurewa volcanoes; (13) The East Tamaki volcanoes; (14) Browns Island; (15) Orakei volcanoes; (16) Mount Eden, One Tree Hill and associated volcanoes.

IV. *Historic Volcanoes*—(17) Rangitoto.

No doubt further information will resolve the picture of vulcanicity of Auckland in clearer detail. From the data available only a few generalisations would seem to be justified. The earliest eruptions were more definitely explosive than effusive and although tuff eruptions continued throughout the eruptive history of the field there has been a tendency for volcanoes to become more and more of the lava producing kind. It is not possible to discover any pattern of distribution relative to age; both early and late eruptions have taken place in the northern part of the field. Lastly, although eruptions have continued over a long span of time there is no evidence to suggest that the episode of volcanic activity has come to an end. On the contrary, the distribution in time suggests strongly that further eruptions are probable in the future.

POPULATION AND SETTLEMENT ON THE OTAGO GOLDFIELDS, 1861-1870

JAMES FORREST

FOR OTAGO as a whole, the discovery of gold in 1861 was the beginning of a wonderful era. For the vast area eventually set aside as proclaimed goldfields[1]—some six million acres by 1870—it marked the virtual beginning of settlement, certainly of intensive land exploitation. For in 1860, what was somewhat vaguely referred to as 'the Interior', was still in the first stages of extensive pastoral development. Two hundred thousand sheep and fewer than three hundred people inhabited the whole of Otago west of the Taieri and east coast plains, and north of the Mataura River and Tuapeka district. With the discovery of gold, this simple pattern of land development was disrupted and transformed by hosts of miners surging across the interior from the scene of one gold discovery to another. This paper is especially concerned with the changing geography of population and settlement under the special conditions of a goldrush.

The Course of the Rushes

Otago's first discovery of gold in payable quantities was made accidentally, early in March 1861, by roadmen working in the Upper Lindis Gorge. Unfortunately, the diggings were poor, winter pressed hard on the discovery, and the field was quickly abandoned when news arrived, early in June 1861, of the rich gold deposits in Gabriels Gully, in the Tuapeka district.

Popular reaction to this first major discovery was everywhere immediate.[2] By mid-July more than 1,200 miners were working in Gabriels, with others already overflowing into adjacent gullies.[3] In mid-September J. T. Thomson, the Chief Surveyor, reported 3,000 in Gabriels Gully alone, and 6,000 in all on the Tuapeka goldfield.[4] By the end of December 1861, there were 11,304 persons here, and another 3,000 in the vicinity.[5] Nearly 6,000 were working in the two main gullies, Gabriels and Weatherstones, another 3,000 to 4,000 about Waitahuna, and, by mid-January, 2,000 more on the recently-discovered Waipori diggings (*Fig.* 1). Yet within six months the total had been reduced to only 7,000.[6] The poorer, higher-altitude Waipori diggings were almost deserted, though miners had spread southeast of Waitahuna and into the sparsely-populated Mount Highlay area. The reason lay in a combination of decreasing returns, the lack of any further major discovery, and the very severe winter conditions.[7] But the exodus was quickly reversed with the discovery of gold in the Dunstan Gorge in August.[8] Few could maintain their indifference to the eighty-seven pounds of gold lodged by Hartley and Reilly, the result of four weeks' work with a broken shovel. Soon hundreds were hastening to the scene of the new diggings, in the heart of Central Otago.

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[1] The goldfields boundary used for Figures 1 to 9 is that of 1867 (*Otago Prov. Gov. Gazette*, Vol. 11, No. 463, 30 January 1867), plus extensions in 1868 and 1869. See *Map of the Province of Otago, with Additions to 1871*, compiled from official surveys and explorations, at a scale of one inch to fifteen miles.

[2] In Dunedin, stronghold of the Presbyterian faith, for example, 'Gold, gold, gold, is the universal subject of conversation . . . On the last Sunday, the congregation at Church consisted of a minister and precentor . . .' *Otago Witness*, 6 July 1861.

[3] *ibid.*, 20 July 1861.

The main initial concentration of miners in the interior was at the southern end of the Dunstan Gorge, near the present town of Clyde. Movement further north was slow being limited by the precipitous nature of the gorge. Meanwhile, other miners working north from the poor, scattered workings along the Mataura River, found gold in Victoria Gully, a tributary of the Nokomai, early in September. The spring thaw set the stage for further discoveries. With the rise in the level of the Clutha many miners were driven off their claims in the Dunstan and moved into the Carrick Range, to Conroys and nearby gullies, across the Carricks to Potters Gully, and south up the Nevis towards the Nokomai diggings. Others, working down the gullies along the northern flanks of the Carricks, opened up the Bannockburn deposits. From here they worked east down the Kawarau, reaching Cornish Point, opposite present-day Cromwell, by November 1862.

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[4] *Otago Prov. Gov. Gazette*, Vol. 4, No. 151, 26 September 1861.

[5] 'Census of New Zealand, 1861', *Otago Prov. Gov. Gazette*, Vol. 5, No. 172, 26 March 1862. Otago's total population was 27,269.

[6] 'Departmental Reports: Goldfields', *Votes & Proc. Otago Prov. Council*, Sess. 16, 1862, p. 18.

[7] *loc. cit.* See also V. C. Pyke: *History of the Early Gold Discoveries in Otago*, Dunedin, 1887, pp. 61-62, quoting John Mouat on the winter of 1862: 'The cold was intense. Boots and clothes were frozen like boards in the night-time, and had to be taken under the blankets and thawed out before being put on in the morning. We had excavated places for our tents—cuttings in the hillsides. These secured them from being blown away, but did not mitigate the cold.'

[8] The discovery was announced in *Otago Daily Times*, 16 August 1862.

By this time there were about 10,000 on the goldfields, but only 800 of them on the Tuapeka. By mid-summer the total had increased to almost 13,000, the bulk of whom were located on the new Wakatipu goldfield (*Fig.* 2).

The few hundred miners in the Cardrona were a residue of many who had crowded into the area in November 1862, before hastening off to Fox's 'private' diggings on the Arrow. Up the Arrow River itself, they had quickly penetrated northwards to Twelve Mile Creek, beyond which the precipitous gorge prevented further movement. Meanwhile, before even the Arrow had been fully explored, others went on to discover the virtually inaccessible, but extremely rich deposits of the Upper Shotover. Yet others pushed on round the shores of Lake Wakatipu as far as Precipice Creek, a tributary of the

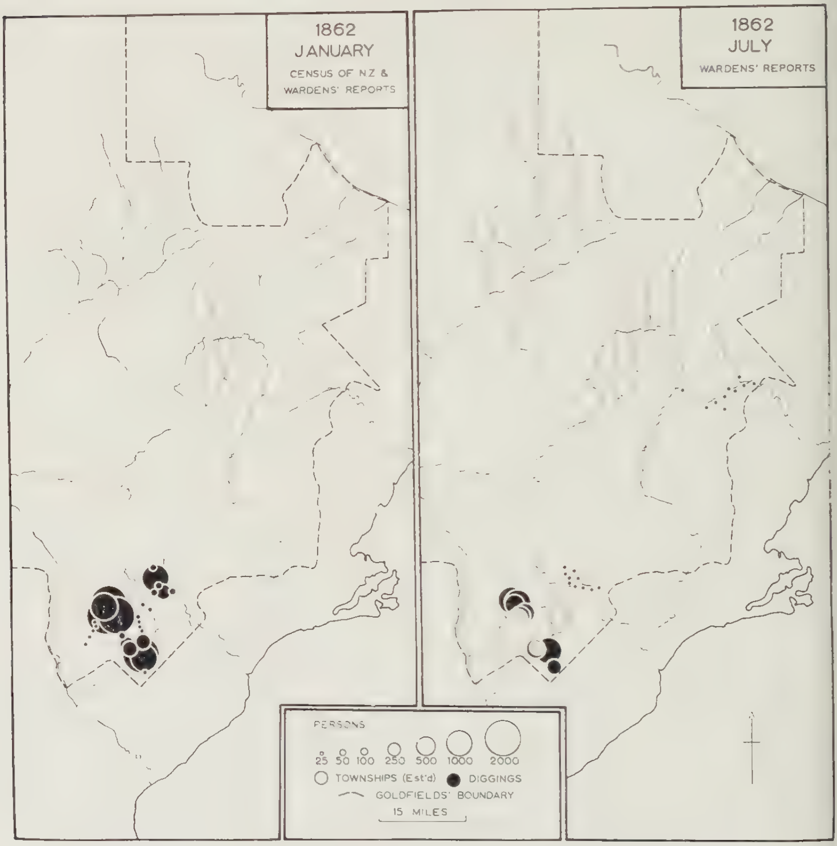

Fig. 1. Distribution of miners, and of others in towns of one hundred or more, 1862

Dart River, in their feverish search for gold. On other goldfields, population accessions had been steady rather than spectacular. The mining population of the Tuapeka, for example, was on the increase, with the return from the Dunstan of many who had so hastily joined in the rush of the previous August and September. Elsewhere, the discovery of gold in the Bendigo area was incidental to the westwards movement of miners from the Tinkers-Drybread area towards Bannockburn, via the river-crossing settlement of Wakefield.

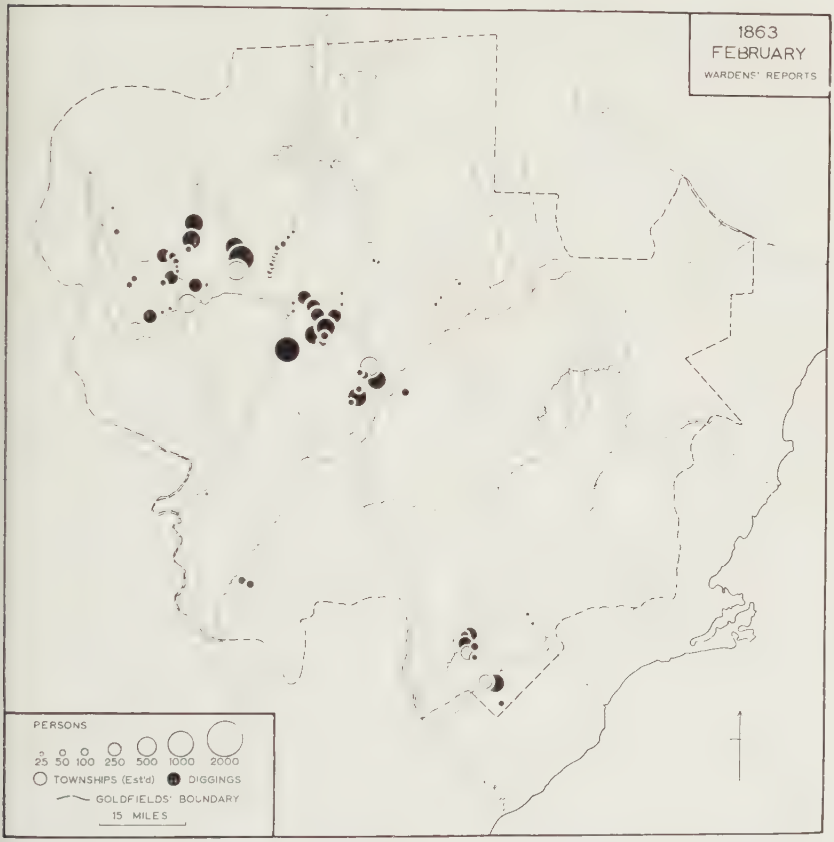

Fig. 2. Distribution of miners, and of others in towns of one hundred or more, February 1863

SEASONAL CHANGES IN POPULATION

The onset of the third winter, and subsequent freezing of the headwaters of the major rivers, reversed this northwestwards trend. Water levels fell, and the richly auriferous sand 'beaches' of the riverine goldfields were again exposed. On the Wakatipu, the position of the miner became almost untenable as snow and ice blanketed the workings and cut off supplies. Conversely, with the spring and summer thaw, it was the riverine districts which rapidly became unworkable as the river levels rose, sweeping away machinery and drowning the beaches in frequent floods. The Mount Ida–West Taieri goldfields did not suffer to quite the same extent from this seasonal variation, although on the Mount Ida the freezing of sluicing water in winter and frequent droughts in summer, were serious problems. On the Tuapeka the only such hindrance was the infrequent freezing of the water supplies from one to two months each year. The result, however, was a characteristic and pronounced winter-summer movement of population between the riverine and non-riverine goldfields (compare *Figs.* 2 and 3). Thus during May of 1863 miners once more began to congregate along the beaches of the Clutha, some miners, incidentally, discovering gold in Campbells Gully, at the headwaters of the Waikaia River, while returning from the Wakatipu (*Fig.* 3).

THE MINING FRONTIER THRUSTS EASTWARDS

At this stage the whole course of discovery was reversed, as overcrowding on the Dunstan turned attention back eastwards, the way many of the diggers had come. Gold had been found both at Moa Creek and in the upper Hogburn by the end of May 1863, but winter prevented exploration. Spring, however, saw the new eastwards movement on to the Manuherikia and Mount Ida diggings begin in earnest. By September about 5,000 persons were gathered on the Mount Ida field mainly about present-day Naseby.[9] From there the workings quickly expanded up the Kyeburn, south along the Taieri to the Fillyburn, then south again in small, widely-scattered groups to Powder Hill, only about six miles west of Dunedin. Eastwards the new diggings extended to embrace the old Highlay goldfield. Meanwhile, up the Manuherikia, the miners moved out on to the Manorburn Flat, north towards Dunstan Creek, and resumed work at the Tinkers–Devonshire–Thompsons Creek diggings.

In May 1863, the wardens' estimates of population totalled 19,000. By September there were an estimated 21,000, including 16,000 miners, and another 3,000 outside the proclaimed goldfields.[10] Yet the footloose character of the mining population, and the absence of wardens from many areas were not conducive to the accuracy of these estimates. Indeed the Goldfields' Commissioner, Vincent Pyke, did have occasion to question the wardens' figures for February 1864.[11]

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[9] 'Second Annual Report on the Goldfields of Otago', *Votes & Proc. Otago Prov. Council*, Sess. 17, 1863, p. 15. It is unlikely that this figure was correct for more than a short time. An average of about 3,000 persons, based on a series of official reports over a month's period, seems a more reason able estimate.

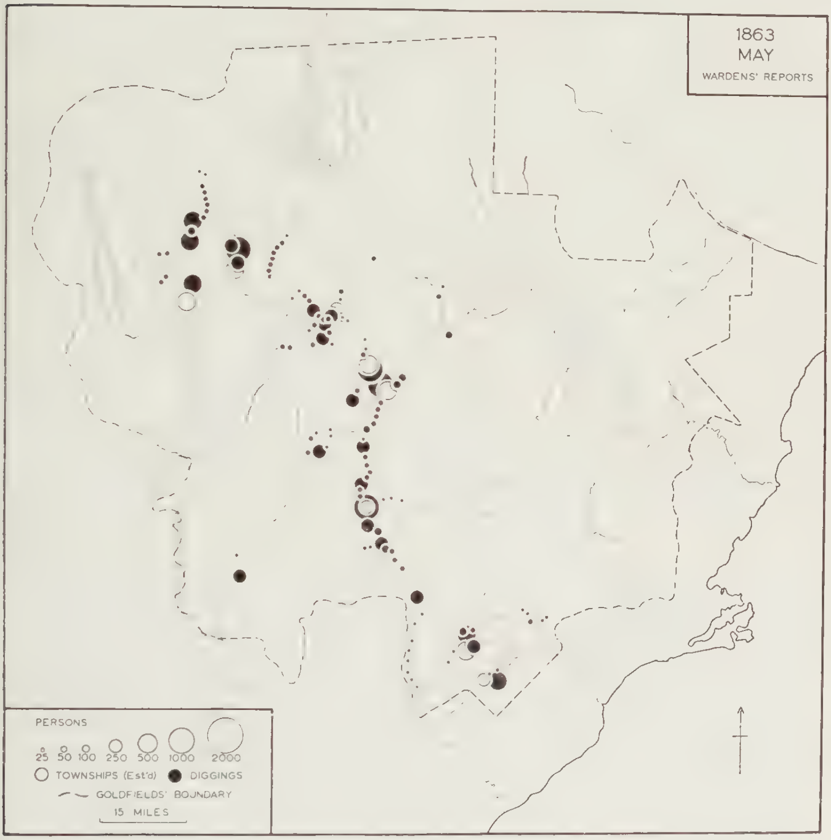

Fig. 3. Distribution of miners, and of others in towns of one hundred or more, May 1863

Their grand total was 26,094. Yet, said Pyke, if this were so, then the goldfields population had increased by more than the total number of immigrants (about 5,000) who had arrived in Dunedin since the previous September. He therefore reduced the total to 23,850.[12] If

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[10] *ibid.* p. 12

[11] 'Appendix to the Departmental Reports', *ibid.*, Sess. 18, 1864, 'Letters and Reports: "O"' p. 87.

[12] He later amended this figure still further to between 22,000 and 24,000, 'of whom probably 18,000 only are miners'. 'Departmental Reports: Goldfields', *ibid.*, Sess. 18, p. 148.

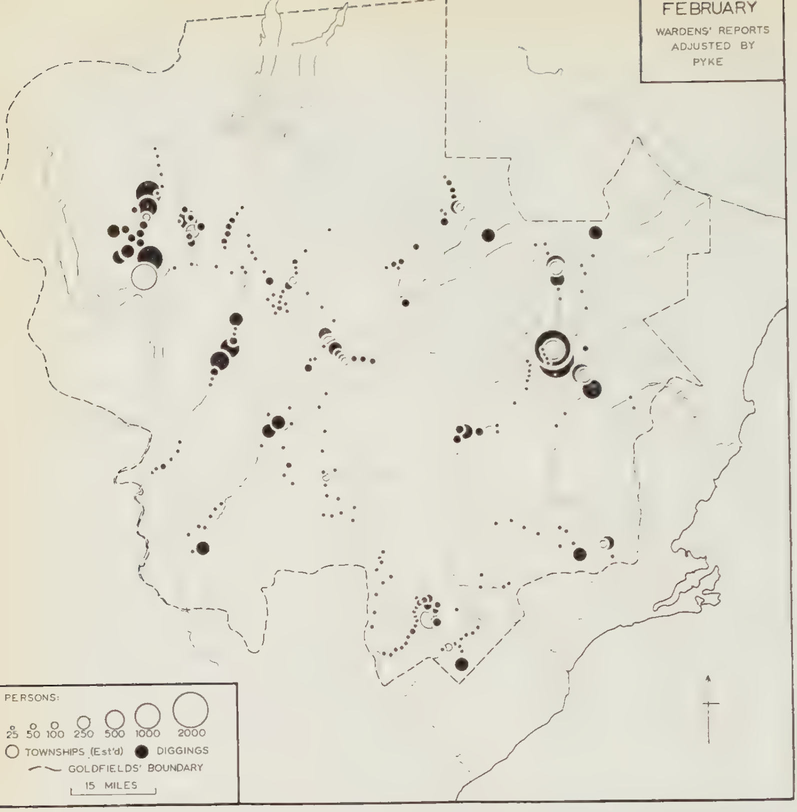

Fig. 4. Distribution of miners, and of others in towns of one hundred or more, February 1864

one accepts a similar exaggeration of the September 1863 figures, February 1864 therefore saw the peak population on the Otago goldfields (*Fig.* 4).

On the Mount Ida goldfield, miners had moved north up the Hogburn to the very slopes of Mount Ida, and up the Kyeburn as far as Clarkes diggings on the slopes of Mount Buster (or Brewster). Southwards, some 4,000 miners, many of them from the Naseby area, were gathered on the new diggings at Hamiltons. Westwards, a large group had gathered right up at the head of the Taieri, along Serpentine Creek. Nearly 1,000 were gathered about Hyde, and another 400 in the vicinity of Hindon. This scattering of miners over large areas was a characteristic feature of the Otago goldfields. In the Dunstan–Mount Benger districts, even at the height of summer, some 10,000 persons were to be found along the banks of the Clutha from Tuapeka Mouth in the south to Wakefield in the north; in the Manuherikia district, miners were located as far north as the slopes of Mount St Bathans. A similar scattering in relatively small groups appears on the Tuapeka

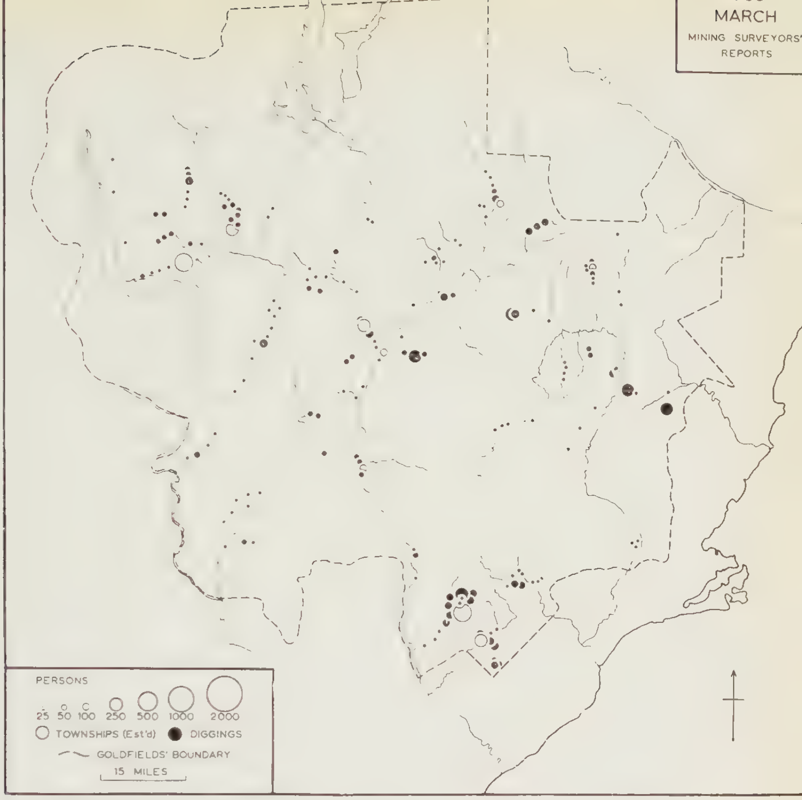

Fig. 5. Distribution of miners, and of others in towns of one hundred or more, March 1865

goldfield. Here, reliable returns from methodical mining, and the all-year-round nature of most of the diggings, had brought about a gradual increase in population—from 800 in November 1862 to 1,728 in May 1863 and 2,100 in September, although it had fallen to about 1,500 in February 1864.

Westwards to the Roaring Meg the Kawarau was lined with diggers on either bank. Immediately west of Queenstown 900 miners were working the lake shore-diggings. The Shotover was being worked from below Arthurs Point to its source. Only in the Arrow and Upper Cardrona districts was the mining population smaller than six months previously. Switzers, Nokomai to a much lesser extent, and the headwaters of the Waikaia–Pomahaka Rivers continued to show an increase in population, while the Nevis district was credited with no fewer than 1,500 miners.[13] In general, this pattern did not alter greatly in succeeding years. The relative size of population groupings varied considerably, but with the exodus to Nelson and the

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[13] This, however, included the upper Kawarau and Bannockburn areas.

West Coast from 1865 onwards the tendency was towards a thinning out of the population throughout the goldfields, rather than any wholesale desertion of particular areas.

THE GOLDFIELDS TOWNSHIPS

After the rapid growth of population in the latter half of 1861, and the equally rapid decline during the succeeding autumn and winter, population increase was maintained at a steady and substantial rate until the summer of 1864. Thus, in the year ended 31 July 1862, of 24,243 persons who arrived from Australia, sixty-eight percent returned. In the corresponding period 1862-63, 31,762 arrived, but only twenty-three percent returned.[14] There was, however, a levelling out of the influx in the latter part of 1863. Between February and September, 1863, the total number of miners increased by ninety percent, businessmen by forty-seven percent.[15] In the six months after September, miners increased by only six percent, businessmen scarcely at all. Nevertheless, the increasing numbers of business residents, the expansion of towns, and the use of more efficient gold mining methods, pointed to greater stability in the life and economy of the goldfields.

Within three months of Read's discovery, over one hundred businessmen had gathered in Gabriels Gully. Half way up the gully, one centre was established with the courthouse and government buildings. Another centre formed at the foot of Blue Spur, as did others at the head of neighbouring Weatherstones Gully, in Monros Gully, and, during 1862, at Evans Flat. In the Waitahuna district, two townships were to be found in the main gully at the height of the Tuapeka goldrush. But these were only local, transitory settlements, quickly established, quickly deserted. Weatherstones in November 1862 was a typical example, consisting not only of banks and business houses, but fourteen hotels, as well as dancing halls, saloons and gambling dens, nearly all constructed of canvas mounted on simple wooden frames.[16] A year later, the rush to the Dunstan had depopulated it of all but two old miners.

The more permanent townships which outlasted the vicissitudes of Otago's golden decade, had similar beginnings. They survived and grew, either because they were situated so as to be able to serve a wide area, or because they formed an essential link in the system of communications. Thus Lawrence, established where the streams from Weatherstones and Gabriels Gullies converged, was centrally located to serve all three gullies to the north, the flats about the town, and the miners along the Tuapeka River. Havelock served in a similar way for the Waitahuna area. Further north, Roxburgh, main scene of gold-mining on the Mount Benger goldfield, quickly gained dominance over the other small settlements at Teviot, Ettrick, Moa Flat, Horseshoe Bend and Chamounix.

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[14] Figures based on returns for immigration and emigration published in the 'Second Annual Report on the Goldfields of Otago', *op. cit.* p. 8.

[15] Business men are sometimes listed in the Goldfields Reports as such, sometimes included in 'Others', but in any case they undoubtedly accounted for most of the non-mining population at this time.

[16] See W. R. Mayhew, *Tuapeka, Land and People*, Dunedin, 1949, pp. 57-59.

Dunstan and the Lakes

After the initial but short-lived supremacy of Muttontown, Clyde was the most important town on the Dunstan, followed by Alexandra and Cromwell. All three began as canvas towns, and such indeed was the shortage of timber that not until late 1862, with the arrival of timber rafted down the Clutha from mills at the head of Lake Wanaka, could they assume a more substantial appearance. Meanwhile, because of the wide spread of the population they served, these three towns were scarcely affected by the seasonal occupation of the nearby riverine diggings. Bannockburn, six miles west of Cromwell, was a less fortunate example. As the supply centre for the Pipeclay, Adams and Potters Gullies, it was subject to marked seasonal fluctuations. Thus from a peak of 325 persons in February 1863, it dropped to twenty-five a year later, at which figure it remained for the next seven years.

In the rush to the Arrow the miners had converged first on the spot where Fox had made his discovery. Here Arrowtown arose. As early as December 1862 the site was marked by a badly laid out canvas town, its two narrow, crooked streets forming a rough L shape, and lined with calico tents of a most rudimentary kind. The following winter brought a series of floods and gales which, between them, almost completely wrecked the town.[17] More permanent building materials were fortunately easy to come by. Prior to setting out up the Shotover, the pioneer miners had camped on the shores of Lake Wakatipu at W. G. Rees's homestead, the only source of supplies. Here arose Queenstown, growing rapidly from 500 in January 1863 to nearly 1,000 a year later.[18] Meanwhile on the Shotover, Arrow and Cardrona diggings, the usual pattern of short-lived supply townships emerged: Maori Point, Arthurs Point, Skippers and Cardrona.

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[17] See F. W. G. Miller, *Golden Days in Lake County*, Dunedin, 1949, pp. 71–74, and *Otago Witnes* 30 June 1863.

In the Nokomai-Nevis areas, owing to the sporadic occupation of the workings, there was not the same sprinkling of townships. One small settlement emerged where the Nevis River was crossed, but otherwise Switzers (Waikaia) was the only main township. On the eastern goldfields, Naseby was the only township out of the canvas stage by 1864, though large shanty towns of 500 people or more had sprung up at Hamilton (Orangapai), Hyde and Hindon.

Exodus and Transition, 1864 to 1866

The startling increase in the goldfields population, between 1861 and 1863, was followed by a period of decrease almost as marked, from 1864 to 1866. During the autumn of 1864, the total of about 24,000 persons gradually fell off as some miners followed the usual custom of spending the winter in Australia.[19] Then, in April, came the news of gold along the Pelorus River in Marlborough. According to one source, about 3,000 miners left for the new diggings in May alone.[20] Pyke estimated that no fewer than 6,000 persons left the Otago goldfields between the end of April and the end of June.[21] However, the exodus was not sustained and with the spring and summer, some miners returned to Otago. Yet those returning cannot have balanced those leaving, for by December 1864 the population of the Otago goldfields was only 15,651.[22]

The first rumours of the West Coast discoveries were reported in Otago in September 1864.[23] The rush there from Otago did not set in till the following February but by the end of March 1865, the new exodus was in full swing. Its effects were widespread, perhaps best summarised by the mining surveyor at Queenstown:

> With the exception of the Upper Shotover, which has lost two-thirds of its population, I cannot name one portion of the field [Wakatipu] that has suffered more from the effects of the rush than another; it has been a complete stampede, and during thirteen years of goldfields' experience, I have never seen the excitement of a rush so general.[24]

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[18] Arrowtown fell from 500 to 450 over the same period.

[19] 'Second Annual Report on the Goldfields of Otago', *op. cit.* p. 8.

[20] *Mackay's Otago Almanac*, Dunedin, 1865, p. 75.

[21] 'Departmental Reports: Goldfields', *Votes & Proc. Otago Prov. Council*, Sess. 20, 1865, p. 64

[22] *Statistics of the Colony of New Zealand*, 1864, Part I, Auckland, 1866.

[23] *Otago Witness*, 3 September 1864.

[24] 'Departmental Reports: Goldfields', Sess. 20, *op. cit.* p. 87.

By the beginning of April 1865, only about 12,000 persons remained on the Otago goldfields[25] (*Fig.* 5). The mining population of the Wakatipu in fact fell from 3,122 in June 1864 to 1,129 in March 1865, that of the Tuapeka from 2,556 to 1,951, while on the Dunstan, 'every day sees our population growing smaller by degrees . . .'.[26] This time the exodus was sustained, and by November 1865, the total population had fallen to 10,845, including only about 6,000 miners.[27] In the six months to March 1866, however, the rate of emigration slackened a little. On four of the goldfields—Tuapeka, Wakatipu, Mount Ida and West Taieri—population numbers steadied, even showed a slight increase, but this was only local, the result of the summer redistribution of miners. In any case, continued exodus from the riverine districts and the Nokomai goldfield brought the Otago goldfields population as low as 10,000 in March 1866.[28]

THE NON-MINING POPULATION

Between February 1863 and February 1864, there had been a ninety percent increase in miners, a forty-seven percent increase in non-miners. Between February 1864 and March 1866, there was a decrease of sixty-six percent and fourteen percent respectively. Expressed as a ratio of miners to non-miners, the gap widened from 2.8 to 1 in February 1863 to 4 to 1 a year later. Over the second period it narrowed to 1.5 to 1. In neither case was the non-miner so affected by the influx or efflux as the miner. This comparative stability of the non-mining population simply reflected the way in which the goldfields as a whole settled down after the hectic rush period. For the goldminer, 1864 to 1866 was a period of transition from the enthusiasm of goldrush days to the more sober outlook of a regular industry. It was generally the footloose who joined the exodus to Nelson and the West Coast. Those with good, paying claims remained, settled down, formed companies, invested their earnings, and generally promoted the growth and stability of business and settlement. And as the menfolk settled down, their womenfolk began to join them, and children too made their appearance on the goldfields. In December 1861 there were only 146 females on the Tuapeka.[29] No children were recorded. Three years later, the total number of females on the Otago goldfields had increased to 2,375.[30] There were also 1,438 males under the age of twenty-one, though otherwise children were not specifically mentioned.

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[25] Calculated from detailed population returns in the 'Goldfields Report', Sess. 20, *op. cit.*

[26] *Otago Witness*, 1 April 1865.

[27] 'Departmental Reports: Goldfields', *Votes & Proc. Otago Prov. Council*, Sess. 21, 1865, p. 39A.

[28] Calculated from the mining surveyors' reports for the quarter ended 31 March 1866, as they appeared in the *Otago Witness*, 1866: 5 May (Wakatipu), 2 June (Mt Ida–West Taieri), 16 June (Dunstan–Mt Benger–Manuherikia, and Tuapeka).

Meanwhile, as returns from goldmining fell from the peak levels of the rush period to something like a regular weekly return, some men, noting the market provided by the miners and the high cost of carting foodstuffs all the way from Dunedin, turned from goldmining to agricultural development. Thus commercial agriculturalists began to take up the small, ten-acre government-lease farms.[31] Others, businessmen and miners, often with families, turned to the half-acre town lots. Between April 1864 and April 1865, the amount of land under cultivation in ten-acre sections increased from 787 acres to 1,693, while the number employed in agricultural pursuits rose from less than 300 to more than 400.[32] The greater part of this acreage was on the Tuapeka, where, by mid-1864, 406 acres were under cultivation on the Tuapeka Reserve alone. On the Dunstan goldfield, intensive farming, with main emphasis on market gardening, centred on the Waikerikeri Valley, near Clyde. But the total cultivated area was small, only 170 acres in April 1865. Meanwhile, because of its distance from supplies in Dunedin and Invercargill, the Wakatipu showed a considerable increase during 1864-1865: from 150 cultivated acres in June 1864[33] to about 500 ten months later.

Early in 1864, town sections were on sale at Lawrence, Waitahuna, Cromwell, Clyde, Queenstown, Frankton and Kingston. By April of that year Alexandra, Roxburgh, Hamilton and Mount Ida (Naseby) had been surveyed and were shortly available for purchase of sections. Throughout the goldfields then, 1864-1866 saw the towns rapidly assuming the 'healthy and prosperous air' attributed to Weatherstones where, after recovery from the exodus of 1862, 'the dwellings begin to assume the appearance of homes, and in many instances well-furnished gardens are attached to them.'[34] At Clyde, 'the miserable little shanties . . . are all gone. Handsome hotels and concert halls have been built,'[35] while at Hindon the formation of gardens in and about the town attested to increasing maturity.

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[29] *Census of New Zealand*, 1861.

[30] *Statistics of the Colony of New Zealand*, 1864.

[31] The Goldfields Act of 1858 did not allow the sale of town or agricultural sections. This anomaly remained until the Act was amended in 1862, when new regulations allowed a seven-year lease of up to ten acres at a low rental, but without the right of purchase. However, these regulations did not extend beyond the Tuapeka goldfield until late in 1863. The 1862 amendment also allowed every holder of a miner's right a town section of half an acre, with full rights and title, or compensation if his land subsequently proved auriferous.

[32] Figures are based on 'Departmental Reports: Goldfields', Sess. 18, p. 147, and Sess. 20, p. 66.

[33] 'Reports of the Goldfields Mining Surveyors', *Votes & Proc. Otago Prov. Council*, Session 19, 1864, p. 13.

However, the goldfields towns and settlements did not escape the demographic upheaval of 1864-1866. Certainly, there were general increases in the number of applications for town residence grants, but this must be set against the decline of fourteen percent in non-miners, mainly businessmen, during that period. Thus the rapid working out of claims in the Hamiltons district, for example, followed by the exodus to Picton, caused the abandonment and demolition of many

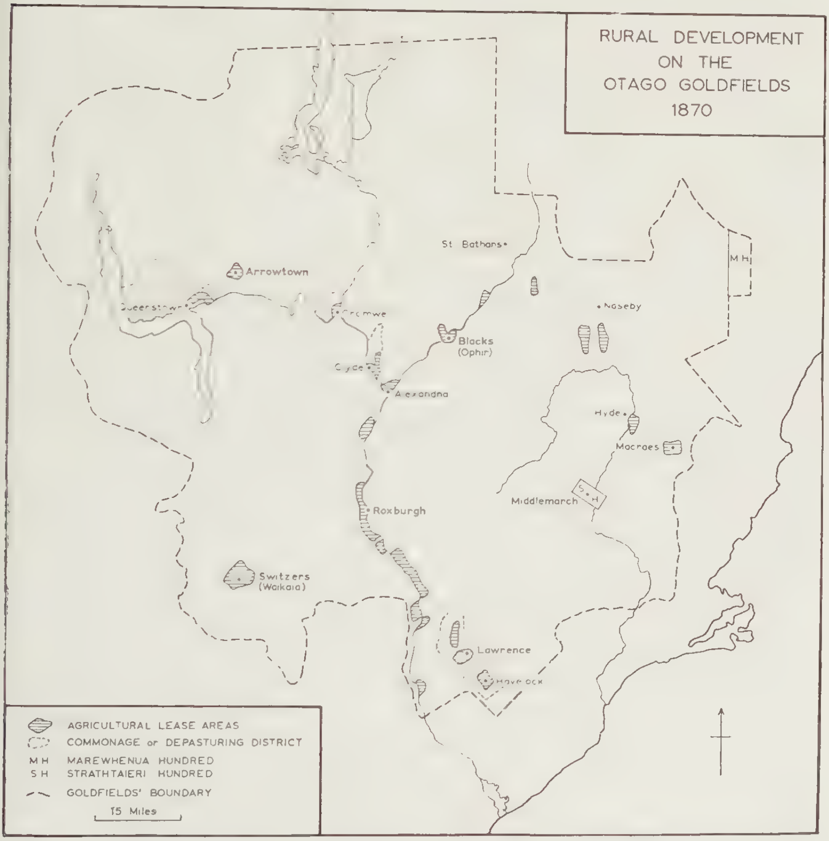

Fig. 6. Areas set aside as agricultural leasehold and commonage, 1870 stores and hotels in Hamilton itself.[36] Hence the anomalous appearance of large gaps in the business areas while, concurrently, new residential areas were growing on the outskirts. As to the effects of the West Coast rush, one can imagine the above picture of Hamilton in October applying in greater or lesser degree, to almost any town on the goldfields.

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[34] *Otago Witness*, 13 February 1864.

[35] *ibid.*, 23 April 1864.

STABILISATION, 1866 TO 1870

In spite of the optimism of some of the goldfield wardens during 1866, the population continued to fall. By December 1867 only 4,414 European miners remained,[37] compared with about 6,000 in March 1866. Clyde, for example, once the scene of perhaps 4,000 to 5,000 miners, now retained a mere forty-four, although Cromwell maintained its position as the centre of an expanding population of 500 or more miners. During 1867, however, the efflux of European miners steadied, then reversed. By February 1871 there were 5,000 European miners on the goldfields[38] (*Fig.* 7), an increase undoubtedly assisted by the development of quartz mining. At the Bendigo reefs, for example, 150 men were thus employed in 1870, while in the Wakatipu district, about a hundred were working the reefs at Skippers. At the same time, there was a slight increase in alluvial miners, associated with the spread to new though comparatively poor diggings elsewhere. North of Cromwell, miners had gradually been working their way up the Clutha since 1867, and had reached Luggate by 1871. In the northeast, others had crossed the Kakanui Range from Naseby to open up the Marewhenua diggings during 1869-1870. Population increases had also occurred in some of the older mining areas, notably around Naseby, Blacks (Ophir), Hyde, Macraes, and in the Waitahuna–Table Hill area. Gabriels, on the other hand, was an area of marked decrease; the Dunstan had been virtually deserted for nearly two years, as had also been the Nokomai and Nevis districts. On this southwestern goldfield, Switzers alone maintained its population. On the West Taieri diggings, Hindon was not even mentioned in 1871.

CHINESE MINERS

Meanwhile an entirely new element had been added to the gold

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[36] *ibid.*, 21 January 1865.

[37] Population according to the census of New Zealand, 1867, in '*Council Report No. 1 of the Goldfields Commission*', tabled on 8 April 1868: MS. in Dominion Archives, Wellington. The total goldfields population was 11,258, including 1,928 businessmen, 3,645 women and children, and 1,270 Chinese.

[38] An estimate, based on the wardens' reports.

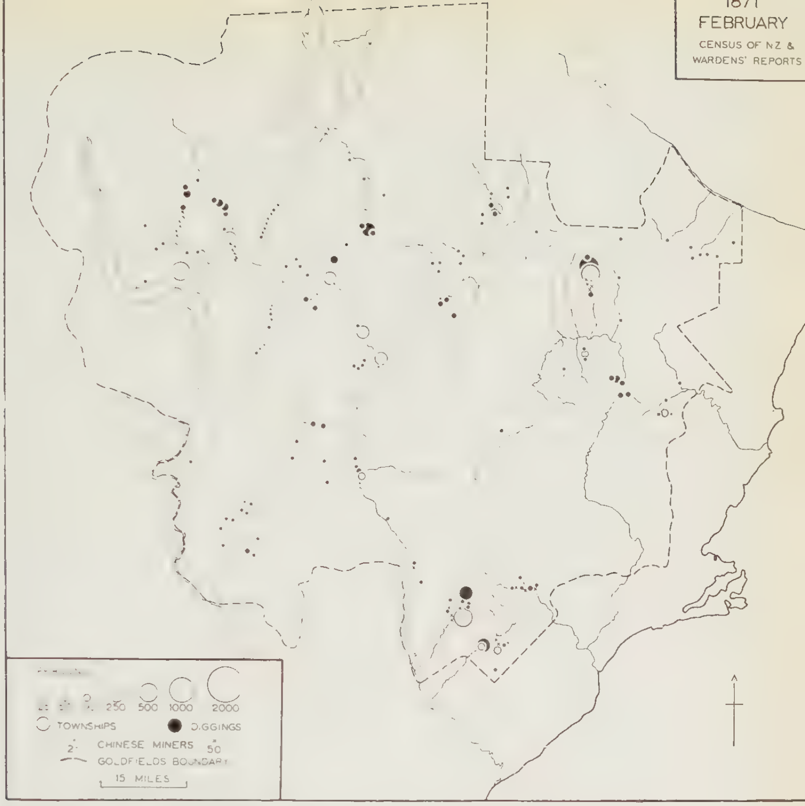

Fig. 7. Distribution of miners, and of others in towns of one hundred or more, February 1871

mining population, the Chinese, who numbered 1,185 by the end of 1867.[39] According to Parcell, they made their first appearance in the Dunstan area in 1864, gradually increasing to become 'quite numerous' by the end of the following year.[40] Two years later, Chinese miners were widely distributed throughout the goldfields; more than 500 on the Tuapeka, some 350 scattered along the banks of the Clutha, about one hundred near Naseby, and a few at Macraes Flat, St Bathans, Blacks and the Upper Shotover. In the next three years their numbers rose steadily to 2,577 by February 1871[41] (*Fig.* 7).

On the whole, the Chinese miner was a useful addition to the goldfields community. He did tend to hoard his gold, pending speedy return to China, and to trade almost exclusively with his compatriots, but as a goldminer he proved industrious and efficient, fully justifying the hopes of the provincial government with regard to the reworking of alluvial ground.[42] In Gabriels Gully the Chinese were quickly at work 'paddocking and sluicing the thrice-washed dirt and gravel,'[43] while on the Dunstan, 'not only are they working the beaches and banks that first attracted them, but they are setting in for works of a more permanent nature, and in some cases bringing up water-races.'[44] From the point of view of population distribution, they brought about a fresh concentration of miners in areas deserted by Europeans, (*Fig.* 7); they also maintained population in areas which would otherwise have been deserted much sooner. At the same time, they left no distinctive mark apart, perhaps, from their type of dwelling. Scorning the calico tent, the Chinaman preferred a hut

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[39] *In-letters*, Otago Provincial Council, No. 11:893. This total superseded the provisional 1,270 mentioned in footnote 37.

[40] J. C. Parcell, *Heart of the Desert*, Dunedin, 1951, p. 89.

[41] *In-letters*, Otago Provincial Council, No. 11:893.

> . . . of turf on the grassy plots, of slabs in the bush, of cobblestones on the shingle, of adobe where stones were scarce . . . of whatever stuff came handiest. And for roofing, what better than the bags that held his rice, or thatch of the great tussock of those days?[45]

DEMOGRAPHIC ADJUSTMENT AND AGRICULTURAL EXPANSION

Within the goldfields population a general settling down and the maintenance of the trend towards a more 'normal' population structure were reflected in both town and agricultural development, as well as in a progressively more balanced sex ratio and occupational structure. In 1867, the ratio of males to females on the Otago goldfields was one hundred to thirty, compared with one hundred to eighteen in 1864, one hundred to one in 1861. By 1871, it had narrowed to one hundred to forty-seven, and might have been narrower but for the increase of European miners towards 1870.[46] The structure of the population in 1867 (Table I) and area in crops in 1871 (Table II), reveal the differential rate of progress among the goldfields.

The area in crops (Table II) also indicates the considerable expansion of agricultural farming, most of which took place after 1866, when the ten-acre limit on leased land was raised to fifty acres.[47] The reform was a popular one, and about Arrowtown, for example, twenty-two fifty-acre blocks were applied for during February 1866 alone.[48] Landscape repercussions throughout the goldfields may fairly be summarised in a report from the Arrowtown warden seven months later.[49]

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[42] It was with this aim in mind that the provincial government refused the request of the miners to prohibit the immigration of Chinese. For a summary of the arguments for and against the introduction of the Chinese, see *Otago Witness* editorial, 30 September 1865.

[43] *ibid.*, 24 July 1866.

[44] *ibid.*, 10 August 1867.

[45] G. N. McNeur, *The Church and the Chinese in New Zealand*, Dunedin, 1951, p. 10.

[46] These ratios are based on official census returns. In all cases Chinese have been excluded, so as to maintain continuity with the period before their arrival.

[47] This provision dated from the Goldfields Act, Amendment Act (1865), which came into effect the following year. Right of purchase was added in 1866. Fifty acres was still thought too little, mainly from the point of view of running cattle as well as cropping. But in January 1867 the provincial government stressed the fifty-acre limit, and nothing was done beyond the maintenance of provisions setting aside certain areas as commonage for the depasturing of stock (*Fig.* 6): See *Otago Prov. Gov. Gazette*, Vol. 6, No. 275, 11 November 1863, and *ibid.*, Vol. 12, No. 553, 24 June 1868.

> The features of all the flat country round Arrowtown are rapidly changing; in all directions the plough is busily at work, and no time is being lost in fencing the land and erecting neat homesteads upon it.

Thus was the tall tussock of former days giving way to fields of oats, potatoes, wheat and barley. In succeeding years the impetus was maintained, and of the 16,500 acres held in agricultural leases on the Wakatipu goldfield by the end of March 1870 over 5,000 acres were under cultivation.[50]

TABLE I

POPULATION STRUCTURE BY PERCENT OF TOTAL POPULATION ON EACH GOLDFIELD, 1867

	Miners	*Others*	*Women and Children*	*Total Population*
Tuapeka	33	19	48	2,856
Wakatipu	30	27	43	1,602
Dunstan–Mt Benger	50	18	32	2,370
Mt Ida–West Taieri–Manuherikia	54	20	26	2,766
Nokomai	72	7	21	494

Source: Council Report No. 1 of the Goldfields' Commission (1868), *op. cit.*

EXPANSION OF TOWNSHIPS

Urban development followed similar trends. In 1867 the population of the goldfields towns was 2,110.[51] By 1871 it had increased to 2,879,[52] a growth reflected not only in residential areas, but in the commercial cores as well.[53] In the 'townscape' itself, the use of stone and brick as a building material for the business houses further reflected progress away from the shanty towns of the goldrush period. Thus in January 1869, a reporter commented upon what he considered to be three stages in the growth of the goldfields town: calico, then weatherboarding, followed by brick and mortar.[54] He described Lawrence as a town where

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[48] *Otago Witness*, 17 March 1866.

[49] *ibid.*, 15 September, 1866.

[50] *ibid.*, 23 April 1870, wardens' reports.

[51] *Statistics of the Colony of New Zealand*, 1867, Part I, Wellington, 1868. The towns were Lawrence, Queenstown, Clyde, Alexandra, Cromwell, Arrowtown, Hamilton, St. Bathans and Havelock.

[52] *Census of New Zealand, 1871*, Wellington, 1872, Table 3.

[53] See *Mackay's Otago Almanac*, Dunedin, 1866 to 1871 (published annually): lists of commercial establishments. Care should be taken, however, with these lists. Clyde, for example, was described in 1869 as 'dwindled down to a mere handful of erections', (*Otago Witness*, 25 September 1869), an opposite impression to that conveyed by the directory. But this is the only apparent exception.

> . . . calico has completely disappeared, and weatherboarding is rapidly giving place to stone and brick. In this respect Lawrence is ahead of many of the other goldfields towns, although at the Dunstan [Clyde] a start has been made.

Meanwhile dwelling houses of sod, wood, and iron had nearly everywhere replaced the earlier, ubiquitous calico.[55]

TABLE II

ACREAGE IN CROPS BY ELECTORAL DISTRICTS
FEBRUARY 1871

Tuapeka	7,892
Wakatipu	5,860
Dunstan	3,222
Mt Ida	1,467
Waikaia	1,772

Source: Census of New Zealand, 1871, *Statistics of the Colony of New Zealand*, Table 22, Wellington, 1871.

In the transitory townships and mining settlements the position varied considerably in the years 1866 to 1870. Of the thriving township of 1861, half way up Gabriels Gully, nothing remained in 1869 but a few sod chimneys or turf walls.[56] Blue Spur township nearby, on the other hand, flourished. On the Wakatipu goldfield, Maori Point (Charleston) had dwindled to 'two stores and some government buildings' by the end of 1866, the result of the rush to the West Coast,[57] while the population of Nokomai township in 1870 was described as 'trifling.'[58] Elsewhere quartz mining was a significant factor in the creation of new centres. In the Bannockburn area, the small settlement of Quartzville was begun in October 1870, with a store and butchery. Carricktown grew up simultaneously, though by September 1871 it still consisted of only a few shops,[59] while on the Bendigo diggings the main centre in 1870 was the quartz mining settlement of Logantown (*Fig.* 8). Meanwhile, the activities of the alluvial miners gave rise to several new settlements after 1866. Oturehua, for example, formed during 1868 as Rough Ridge, while on the Marewhenua diggings, a mining settlement of the same name consisted of nine commercial concerns by 1870.[60]

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[54] *Otago Witness* 16 January 1869.

[55] See *Statistics of the Colony of New Zealand*, 1867, Census No. 7, and *Census of New Zealand*, 1871, Table No. 7.

[56] *Otago Witness*, 16 January 1869.

[57] *ibid.*, 8 December 1866.

[58] *Mackay's Otago Almanac*, p. 238.

[59] Parcell: *op. cit.*, pp. 83-86.

Gold Workings and the Pattern of Settlement

Apart from the relatively insignificant quartz deposits in the schist rocks of the uplands, the bulk of the Otago gold came from three major types of deposit,[61] each giving rise to a distinctive pattern of associated settlement.

Of first importance were the gold deposits in the river bed gravels or sands, and river terrace detritus in the riverine districts of the Dunstan and Mount Benger. Associated settlement was therefore at riverside locations—Cromwell, Clyde, Alexandra, Roxburgh, to name only the main ones. A noticeable feature, too, was the large number of smaller settlements south of Alexandra, due to the greater dispersal of gold south of the Dunstan and to the more open nature of the terrain. Within a year of discovery, miners had turned their attention first to the rich terrace deposits between Clyde and Alexandra. Then, as emphasis shifted from the lower to the upper Dunstan with the gradual working out of earlier mined areas, Clyde went into relative decline, retaining only its commercial and administrative functions. Conversely, Cromwell continued to expand, while Alexandra and Roxburgh retained their importance as service, mining and agricultural centres. On the Nokomai goldfield, Switzers township, and the mining settlements of Nevis and Nokomai, arose and developed, or declined, in much the same way.

Next in importance were the deposits at the base of the hard-rock uplands confining the Maniototo, Manuherikia, Ida Valley and Cromwell basins. Here the gold, being of high specific gravity, tended to concentrate at the break of slope as the streams levelled out on to the plains. Such, however, was the extent and nature of the deposits, and local working conditions,[62] that settlements on these basin-margin

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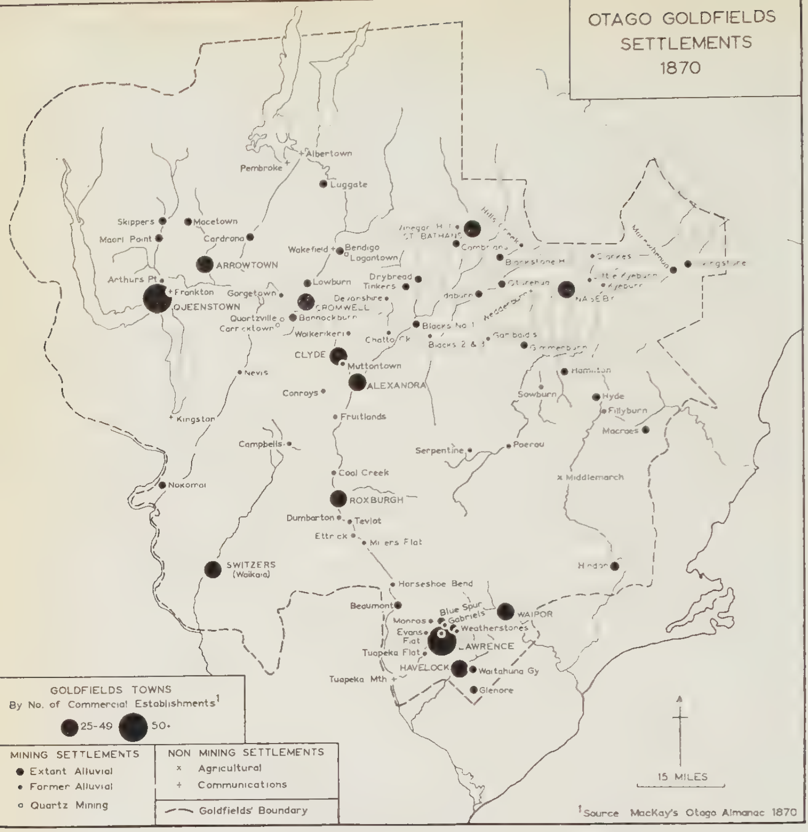
[60] *Mackay's Otago Almanac*, p. 246.

[61] Murray McCaskill: *The South Island Goldfields in the 1860s*, address to the Wellington Branch of the New Zealand Geographical Society, 15 July 1959.

[62] See J. H. Williamson: 'Geology of the Naseby Subdivision', *Geological Survey Bull. No. 39*, Wellington, 1939, pp. 106–116.


OTAGO GOLDFIELDS SETTLEMENTS 1870

[1] Source MacKay's Otago Almanac 1870

Fig. 8. Towns and settlements on the Otago goldfields, 1870

diggings fell into three main groups. First, the two main settlements of St. Bathans and Naseby. Second, the smaller, but still comparatively-stable mining settlements based on the sluicing of the quartz drift deposits: Tinkers, Cambrians, Devonshire, Blacks, Macraes and Clarkes, for example. Third, the 'fly-by-night' type of settlement, initially the scene of large numbers of miners, but quickly losing the bulk of these with the rapid working out of payable deposits. This group included Hyde, Hamilton, Hindon, Conroys, Bannockburn and Bendigo.

The main sources of gold on the Wakatipu, the high-level terrace deposits, were laid down by tributary streams feeding into glacial valleys. The physical character of the goldfield was such, however, as to impose considerable limitations on the development of settlements. Thus, apart from Arrowtown, the only associated townships were small—Skippers, Maori Point and Arthurs Point. Instead, Queenstown, the main town of this goldfield, grew as a supply and winter refuge centre some miles away from the principal diggings. For this

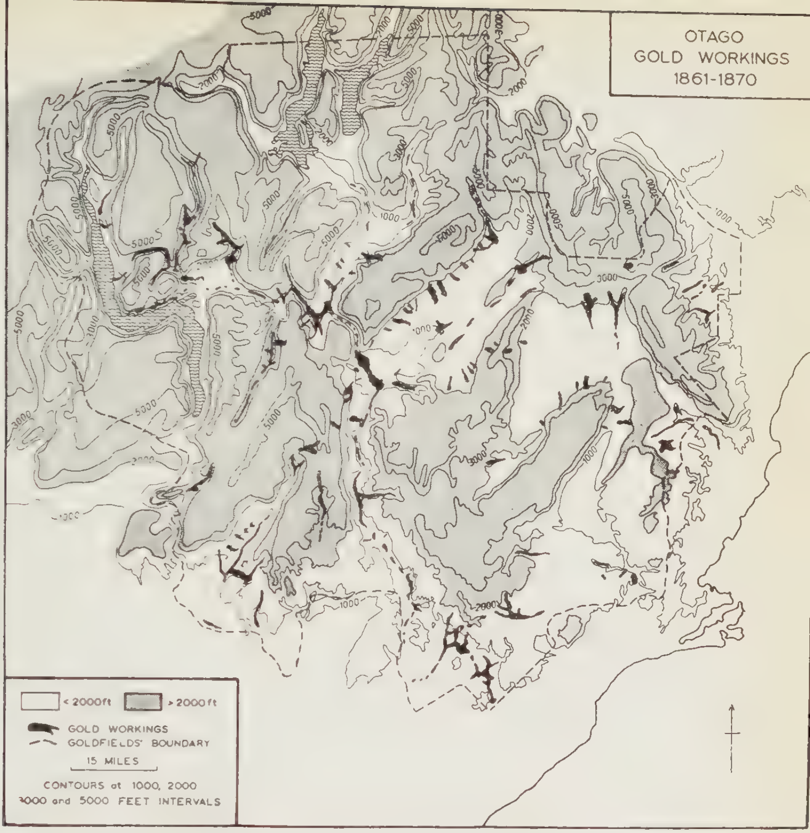


Fig. 9. Location of the main alluvial gold workings

reason too, Queenstown was sustained for many years till the advent of the tourist industry, while Arrowtown remained as the centre of local agricultural development.

On the Tuapeka goldfield, it was undoubtedly the presence of the rich spur conglomerates—the third major source of gold—which caused the remarkable stability of this area, and the scattering of gully, then spur, settlements round the major supply and administrative centres, Lawrence and Havelock (Waitahuna). This district was further fortunate in having excellent conditions for agricultural development.

A significant feature of this pattern of settlement, largely hillfoot and riverside, is the way in which it has been maintained ever since. Only in the Cromwell and Maniototo basins has there been any addition to it, and in the latter case this is represented only by Ranfurly, creation of the Otago Central Railway. Few indeed were the settlements of 1870 not intimately connected with gold mining: only Wedderburn, Kingston, Tuapeka Mouth,[63] Pembroke and Albertown as communications centres; and only Strath Taieri (Middlemarch) as an agricultural centre (*Fig.* 8). On the other hand, many of the mining settlements at higher altitudes, or in more inaccessible areas—Clarkes, Garibaldis, Conroys, Skippers, Macetown, Quartzville, for example—have long since faded into obscurity, remembered only in name, as a post-office collection box, or an old hotel.

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[63] Tuapeka Mouth (or Dalhousie) was an instance of mining settlement coupled with transport function, as an inland port of call for the Clutha paddle steamers.

Conclusion

For the Otago goldfields, the years 1861 to 1870 were years of spectacular change. At the heels of the miner came the businessman. Shanty towns sprang up, many of them quickly to decay as miners hastened off to other areas; some, however, remained and expanded as major centres of supply, administration, and as sources of capital for the increasingly complex aids to gold extraction—water-races and hydraulic equipment. In turn, the investment in more complex appliances tied the miner down to specific localities, and a more stable population, in town and on diggings alike, caused attention to turn to agricultural development, especially market gardening. Such development was not extensive by 1870, but it was a beginning, and its location reflected the close association with mining interests (*Fig* 6). In the towns the transition was reflected in building materials, from calico to wood and corrugated iron, then to stone and brick. Women and children began to appear in increasing numbers, and a goldrush merged gradually into a regular gold mining industry. Many years were yet ahead during which the effects of the gold discoveries worked themselves out in the regional demography of the goldfields. In the pattern of settlement, even in the landscape itself, the effects are still vividly present, a lasting contribution to the geographic character of this region.

LAND DEVELOPMENT IN SOUTHLAND

LESLIE SYMONS

SOUTHLAND has recently become a district of major importance in the government land development programme. In 1960 blocks being improved by the Department of Lands and Survey totalled 166,500 acres, about 90 percent of all land under state development in the South Island, and 17 percent of that in the country as a whole. It is estimated that in the Southland Land District there are altogether about 800,000 acres of partially-developed and undeveloped lands, in addition to 1,405,000 acres of pastoral country. Whereas in the North Island large areas of unoccupied Crown land have been available for development since the second World War, this has not been the case in the South Island. Land for development has had to be acquired by purchase, or on the termination of pastoral leases.

All the land for development is vested in and managed by the Department of Lands and Survey, the Department of Maori Affairs being not concerned as it is in the North Island. Many features of the development of the Taupo country in the North Island, as described by Ward,[1] apply in Southland, including the three phases of development—primary (burnt over and ploughed but not yet grazed), secondary (grazed in large state farms) and tertiary (subdivided and privately settled). As in the North Island the grazing by sheep and cattle in the secondary stage has the function of improving land.

The Tussock Lands

Almost 148,000 acres of land, formerly held in seven pastoral runs, is now under state development in the area bounded by Mossburn, and Lakes Te Anau and Manapouri. The whole area is covered by glacial and fluvioglacial deposits comprising moraine and glacial lake terraces, with the recent alluvium in the river valleys. Some of this country is still covered by native bush which was undoubtedly more extensive before its destruction was begun by the Maori and continued by European settlers.

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[1] R. G. Ward: 'Land Development in the Taupo Country', *N.Z. Geographer*, Vol. 12, No. 2, October, 1956, pp. 115-132.

Two main plant associations, tussock grassland and scrub, comprised the vegetation at the beginning of the present development, the scrub being mainly of manuka (*Leptospermum scoparium*) and fern.

The soils are shallow and sour. There is normally a hard pan present, but it is not deliberately broken up during cultivation, even where it is near the surface, since this would result in over-rapid drainage. Rapid saturation in occasional heavy rains is considered preferable. The supply of water to farms is, however, a major problem. Surface water is virtually confined to rivers which are too far below the farmland to be of much value. Most of the water supply must, therefore, come from bores though the success of these is very variable. Rainwater tanks are a feature of the landscape, but the annual rainfall averages no more than forty inches.

The land under development is below two thousand feet elevation except where it rises to Mount Hamilton (4,898 feet). The land being made arable is between 500 and 1,400 feet, at which heights snow rarely lies for more than a week or two at a time. The higher hills, however, are snow-covered for most of the winter and spring.

About 90,000 acres are being developed, or are scheduled for development, as arable land. On flat and rolling terrain initia cultivation is by plough followed by discs. Much more thorough cultivation, however, is attained by using discs than would be possible by ploughing alone. Slopes which are too steep for the plough are broken up wholly by giant discs. The discs can also cope better with the stony character of the land, the limiting factor being the size of the stones. Where there are many boulders too large to pass between the discs, cultivation is not attempted, land otherwise suitable being then improved by oversowing and topdressing. Oversowing is also used for some of the tussock country which has light soils subject to wind erosion. All superphosphate applications are made by aircraft, and much of the lime is applied from the air.

By the end of the 1960-1961 season 40,000 acres of grass had been established. Only in two blocks, Lynwood and Whitestone, were there appreciable amounts of improved pasture before present development began (*Fig.* 1). Even these areas were run out and required resowing. In the Lynwood block the arable area is now eleven times its original extent. Stock at the time of purchase amounted to 4,350 sheep and 1,100 cattle. These numbers have been increased already to 24,000 and 3,800 respectively, and are likely to reach 32,800 and

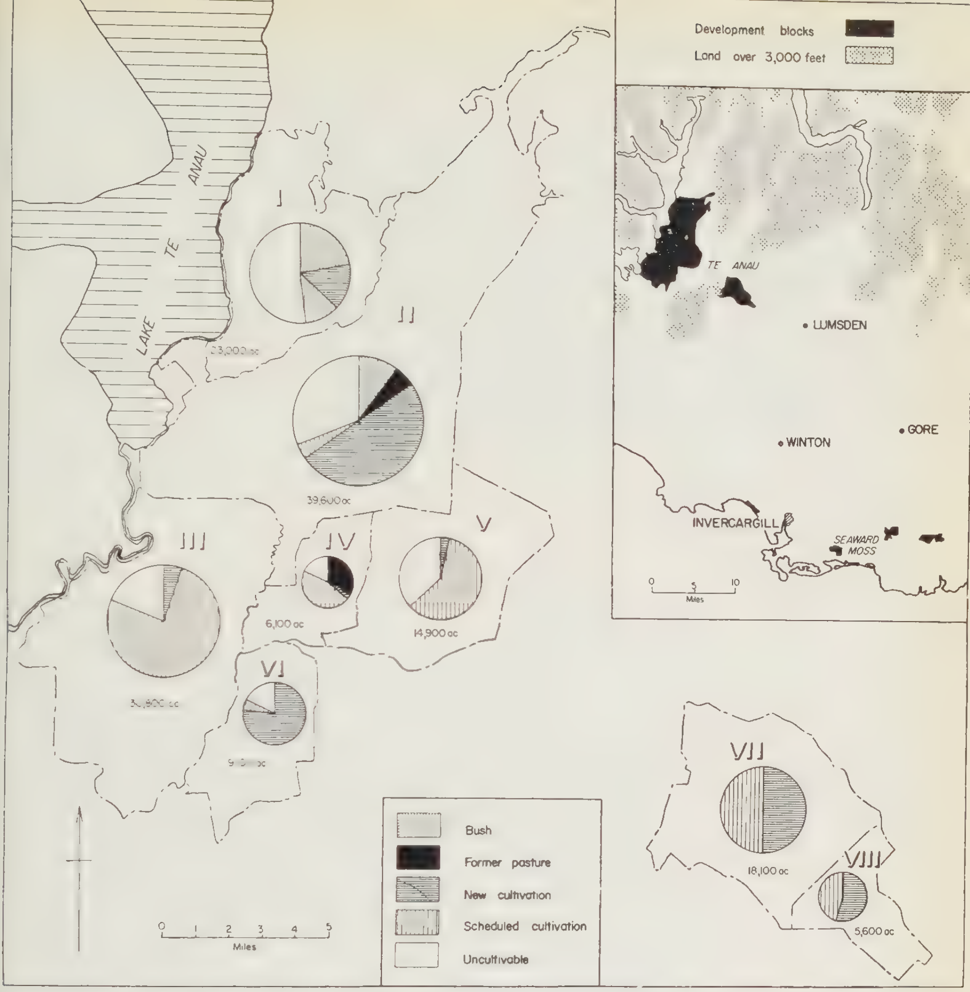

Fig. 1. Properties under development by the Department of Lands and Survey near Lake Te Anau, 1960: i. Te Anau, ii. Lynwood, iii. Mount York, iv. Whitestone, v. Princhester, vi. Takitimu, vii. Mount Hamilton, viii. Sobig.

4,000 in the near future. The last figures represent 1.27 ewe equivalents per acre. Before subdivision into individual private farms the carrying capacity is expected to reach two ewe equivalents per acre.

Some four-fifths of the Takitimu block has been cultivated. Seven thousand sheep and 1,000 cattle are being carried compared with only 1,000 ewes before development. This will be the first block to be subdivided, and fourteen farmers are expected to take up their holdings in 1962. At the other end of the development cycle the Mount York block, carrying only about 1,500 ewes and 200 cattle when taken over in 1958, is eventually expected to yield thirty-eight farms. On the whole Te Anau development area some 43,000 sheep, 2,000 run cows and 3,500 dry cattle are being supported compared with about 11,000 ewes and 1,000 cattle before development. Accompanying the improvement of the land, twenty-four dwellings have been built together with sheds and barns, and service roads.

It is expected that the subdivision will be based on units of about 500 acres varying according to contour and soil type but capable of supporting, in the first place, at least 1,000 ewes and replacements, with a potential of at least 1,500 ewes, together with thirty to forty cows. Beginning with the Takitimu block, the process of land development, subdivision and settlement is expected to extend over a period of about twenty years.

The More Developed Country

State development taking place on this class of land has consisted essentially of buying farms offered for sale, improving the land and buildings, subdividing, and selling as complete farm units. At present some 14,000 acres are being developed in Southland. About 7,000 acres are classified as arable or potentially arable, all being below 1,000 feet altitude. One farm in 1955 supported only 200 ewes and 50 run cows; in 1960 the stock exceeded 4,000 sheep and 250 cattle. This farm will be divided into five units and 5,000 acres of bush will be declared state forest.

This class of development was the only kind being conducted by the Lands Department in Southland for some years. It began in 1941 when the department acquired an estate of 2,213 acres and was extended to 10,000 acres in 1946. The farms created from these blocks were made available to returned servicemen and as the demands on land for this purpose increased more blocks were added. The maximum area under development at any one time was 62,000 acres.

The Peat Lands

Some 60,000 acres of peaty soils occur on coastal alluvium in the area known as Seaward Moss. Improvement is in the extensive areas where there is from three to six feet of brown, fibrous, peat resting on a white marine gravel. Mosses dominate the vegetation, with some manuka. Deeper peats—there are known depths of up to sixteen feet of raw, water-logged peat—are not at present regarded as likely to be economically improvable for agriculture.

Fig. 2. Land development on the Te Anau block. A crawler tractor pulls chain harrows in the final preparation of the ground before sowing. In the background are the Murchison mountains of Fiordland

Fig. 3. Newly established pasture on land formerly covered in manuka scrub on the Kakapo block near Lake Te Anau. The cattle play an important role in the establishment and consolidation of a good pasture sward

Fig. 4 Sheep grazing new pasture on the Lynwood block, Lake Te Anau. The few scattered self-sown pine trees provide welcome shade for livestock on the largely treeless development blocks

Photos: D. R. Rinkes

On the 3,000-acre Waituna block and 1,400-acre Kapuka block, at present being developed by the Department of Lands and Survey, drainage was greatly improved by cleaning out and deepening three important creeks. Main drains and a grid system of channels were then put in, mats being used to support the excavator on the wet and spongy surface. A heavy, winch-operated mole plough is used to assist drainage, and this is also effective in bringing to the surface the bog timber which occurs in considerable amounts and hinders drainage work. Following drainage the land is left to consolidate for about two years.

As soon as the ground is dry enough to carry a crawler tractor the surface cover of moss and scrub is cut up with a rotary hoe or giant discs and when the vegetation has dried out it is burnt. The hoeing and burning may be repeated. The land is then cultivated and limed. The lime may be applied at the time of rolling, or it may be applied separately from the air. A standard grass-seed mixture is used, perennial ryegrass being the main constituent. Topdressing, and the application of trace elements and further quantities of lime follow the normal Southland pattern, regulated as required by the condition of the established pasture. Mole drainage is also continued after the pasture has become established.

The uneven consolidation of the peat and the effects of continued mole drainage has in some cases resulted in an uneven surface, especially after about three years, while compaction of the peat leads to the appearance of old tree stumps formerly buried a foot or more below the surface. Such changes complicate pasture management, hindering mowing and generally increasing the cost of development.

Reversion of pasture leads, however, to experiment which may indicate changed lines of development. Thus, some 200 acres of six-year-old pasture, broken up because of rush infestation, was sown out to swedes and for a winter period of about ten weeks supported 4,500 ewes, 600 hoggets, and over 300 cattle.

On 1,770 acres of land so far sown to grass in the two blocks, the normal stock is now about 3,500 sheep and 100 cattle and lambs are fattened on the consolidated pastures. The present programme aims at doubling the area of arable land on these blocks and in due course creating eight farms, but the difficulties of development make this a comparatively long term project with no date set for its completion.

MARGINAL LANDS AID

Where improvement of privately-owned land is hindered by finance being initially unobtainable from banks or other institutions, the government may make a loan under the Marginal Lands Act, 1950 which is administered by the Department of Lands and Survey. In Southland, 76 loans were granted in the first ten years of the scheme, averaging £3,850. Many of the farms being developed in this way are on the fringes of Seaward Moss.

In addition, there have been many wholly private development schemes initiated in recent years. In December 1960 a private scheme to develop 19,000 acres of Seaward Moss was announced.[2] It appears that the intention is to improve the land and subdivide into economic units, some of which will be sold in a manner similar to that employed by the Lands Department. The land has been leased from the Crown for twenty years in the first place and the company plans to improve and put down to grass one-third of the area in the first ten years of operation and a further one-third in the following five years.

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[2] *Southland Times*, 20 December, 1960.

GEOGRAPHIC NOTEBOOK

IN THIS ISSUE. The conversion of the North Island rainforest into grassland was perhaps the most spectacular episode in man's transformation of the New Zealand landscape. Unfortunately, few settlers in the bush country had the time or inclination to write of their experiences as pioneers and few diaries appear to have survived of day-to-day farm activities. Mr Johnston's discovery and analysis of the diaries of a Taranaki smallholder thus represents an important contribution to the study of the processes of landscape change and to a poorly-documented phase of our social history. Mr Johnston is Secretary of the New Zealand Geographical Society and a Senior Lecturer at the University of Canterbury.

On 8 June 1861 the Dunedin newspaper *Otago Witness* published a letter by Gabriel Read describing the discovery of gold in the gully in the Tuapeka district which soon came to bear his name. The gold rushes of the next few years produced some remarkable changes in the population patterns of interior Otago and these have been mapped for the first time by Mr James Forrest. His article serves as a counterpart to a study of the gold rush population of Westland by Dr Murray McCaskill which appeared in the *New Zealand Geographer*, Volume 12, Number 1, April 1956. Mr Forrest, who is Assistant Lecturer in Geography at the University of Otago, carried out the research for this article while preparing his M.A. thesis at the University of Canterbury. It is published, appropriately, in the centennial year of the first Otago gold rush.

The legacy of gold rush origins is evident in many New Zealand towns and townships, in few places more obviously than in Coromandel. The article by Mr E. E. Owen, Lecturer in Geography at Ardmore Teachers' College, describes the unique features of the Coromandel township but some of the conditions he describes could apply to many small and relatively isolated settlements in other parts of New Zealand. Dr E. J. Searle, Senior Lecturer in Geology at the University of Auckland, makes a further contribution to the understanding of the geology and landforms of the Auckland isthmus. His conclusion that further eruptions are probable may be of more than academic interest to those who live in the dominion's largest urban centre.

Dr H. W. H. King, Senior Lecturer in the University of New England, Armidale, New South Wales, describes Australian fishery practice and the problems faced by the industry. This article complements one on the fishing industry of New Zealand by Mr P. D. Dibble which appeared in the *New Zealand Geographer* in April 1955.

Considerable publicity has been given to recent land development in the central North Island. Dr Leslie Symon's report draws attention to the less publicised developments in Southland. Dr Symons is Lecturer in Geography at Queen's University, Belfast, Northern Ireland and spent the year 1960 in New Zealand while occupying a visiting lectureship at the University of Canterbury.

Shorter contributions to this issue have been made by Mr J. W. Hutchings, New Zealand Meteorological Service; Dr G. J. R. Linge of the Australian National University; Mr M. G. A. Wilson of the University of Melbourne; Professor K. B. Cumberland and Mr James W. Fox of the University of Auckland; Drs Jane M. Soons, L. J. King and M. McCaskill of the University of Canterbury; Mr C. M.

Herbert of Papakura High School; Mr R. G. Wilson of Timaru Boys' High School; Mr. J. L. Hewland of the Education Department, Wellington, and Miss Marion McFarlane of Dunedin.

This issue of the *New Zealand Geographer* has been the responsibility of the Senior Assistant Editor while the index to Volume 16 has been prepared by Mr L. S. Suggate.

REHABILITATING THE WEST COAST. During the centennial year of Westland the West Coast Committee of Inquiry submitted to the government its proposals for stimulating economic growth in an area which has recently experienced loss of population and retarded development. In *Report on the West Coast* (Government Printer, Wellington, 1960) the committee offers thirty-five recommendations on mining, land development and forestry, and on such miscellaneous topics as whitebait fishing, aviation and a notional railway. The *Supplementary Report on the West Coast* (Government Printer, Wellington, October 1960) contains proposals on specific manufacturing industries made in the light of an investigation by the Arthur D. Little Survey Group of research consultants of New York. In so far as these reports constitute a blueprint for the future of the West Coast the crucial recommendation is for the establishment of a large-scale forest-products industry based on selective logging and sustained-yield forestry.

The committee's analysis of the problem it seeks to remedy is disappointingly brief and in some respects naïve. The assertion of a 'colonial type' exploitation of the area by outside business interests, particularly by Canterbury firms, and the charge that the West Coast has not always retained the income and wealth generated from its resources need more critical demonstration before they can be accepted as causes of present economic insecurity. Perhaps the mountain barrier of the Southern Alps has led us to regard the West Coast as a watertight compartment in the economic life of New Zealand and has obscured the fact of its interdependence with other areas, especially Canterbury. It could be argued that the milling of native timber in the central North Island and the mining of coal in Southland are largely in the hands of 'outside interests' but without apparent detriment to the local economy. As the committee itself points out, the accumulated loss borne by the state on its West Coast coal mines is about £3,650,000. Some might regard this as a subsidy paid by the rest of New Zealand to grant a number of people the privilege of earning their livelihood on the West Coast. In view of the high degree of mobility of labour in New Zealand no unemployment problem has developed on the West Coast, nor is there any pool of partly-employed or underpaid labour such as might attract manufacturers to set up branch factories. Much of the present concern at the stagnant or declining population is voiced by the small businessman who cannot move to areas of better opportunity as readily as the workman.

In the absence of a clear statement of the nature of the West Coast problem the overriding objective of the committee's recommendations remains obscure. The provision of maximum local employment appears to be one aim whereas the most economical and efficient utilisation of West Coast resources from a national standpoint appears to underlie other recommendations. These two objectives are not always complementary. Nevertheless, the committee does seem to be certain that economic salvation is to be rooted in the utilisation of local resources, and it does not even consider the panacea sometimes recommended for 'problem areas'—state-fostered manufacturing industries processing materials drawn from outside the area.

Some of the recent economic ills of the West Coast can be traced to changes in the coal mining industry during the 1950s. On the one hand technical improvements in mining reduced the need for labour, especially in the Buller field, while during the same period markets for coal failed to expand. The committee recommends that the least economic mines be gradually closed and that a more vigorous sales and merchandising policy be instituted. Its recommendations on the use of slack coal were anticipated by the decision of the Mines Department to establish briquetting plants near Greymouth and Westport. The past history of briquetting on the West Coast is not a happy one and it will be interesting to see whether briquettes can be marketed at a price equivalent to that of screened coal. Curiously enough, ten of the committee's thirty-five recommendations deal with minerals other than coal. These read more as an evocation of the hopes held by West Coasters fifty years ago than as serious measures to promote an early resumption of metalliferous mining.

The expansion of farm output and an increase in the farm population is an obvious measure to promote stability in an area that has been too closely dependent on the vagaries of extractive industries. The government did not require urging by the Committee of Enquiry on this matter and the Department of Lands and Survey has already begun an assault on some of the problem soils which have hitherto proved impossible to farm. Some 18,000 acres are now in various stages of development by the state. These include 2,000 acres of successfully grassed low-terrace soils in the Grey Valley, 1,000 acres of an eventual 9,000 acres on cut-over morainic hills north of Lake Brunner, and minor developments on a very difficult block of 'pakihi' soils near Cape Foulwind. The ultimate success of some of these projects may be uncertain but the committee is in no doubt that much can be done to increase production from the existing farmlands on alluvial soils. This is essentially a matter for private development and will depend largely on the efforts of West Coasters themselves.

The most important recommendations are undoubtedly those in the *Supplementary Report* relating to an integrated forest-products industry. Geographers will probably find the eight-page statement by the American consultants the most interesting reading in the two reports. The timber utilisation problems of Westland (and the land utilisation problems of tens of thousands of acres of cut-over forest) stem largely from the past history of sawmilling. In common with other indigenous forest areas in New Zealand, sawmilling has been carried out by a large number of small, undercapitalised firms conducting their logging operations by clear felling on a wide front. There is a marked geographical separation between the rough sawing of logs at bush mills and the processing and machining of timber near the distant metropolitan markets.

The proposed forest-products industry would require substantial capital outlay and a probable merger of existing sawmill interests in order to ensure the fullest possible utilisation of the podocarp and beech timber resources on a sustained-yield basis. A fully integrated plant would carry out sawmilling, preservative treatment, kiln and air drying, machining, precutting of building timbers and joinery manufacture. Adjacent plants would process a full range of plywoods, fibre boards, particle boards and pulp. Selective logging of mature trees would ensure maintenance of a forest cover, promote regeneration and reduce present wastage. Two major plants are suggested—one near Reefton to serve the beech forests of north Westland and another, probably to the south of Hokitika, to serve New Zealand's largest remaining reserve of podocarp forest on the moraines between Ross and Bruce Bay.

After the publication of the *Supplementary Report* the Fletcher Holdings organisation announced plans to proceed with the establishment of an industry in the vicinity of Hari Hari or Ross along the lines indicated by the West Coast Committee of Inquiry. Nevertheless, many problems remain to be solved and many questions have yet to be answered. Accelerated research into indigenous silviculture and wood technology is an obvious priority. There may have to be a greatly expanded programme of exotic tree planting in north Westland. Nothing is said about the relationship of the seventy existing sawmills to the proposed integrated mills. As the rate of cutting is already much greater than the current growth of timber in West Coast forests it is obvious that existing sawmill interests cannot be assured of supplies additional to the needs of the integrated plants. The new plants will call for a concentration of labour in contrast to the present dispersion and a new town to hold some two thousand people may eventually be required somewhere south of Hokitika to serve the podocarp area. What would be the effect of such developments on existing service centres and on the existing timber-processing industries in Canterbury? Can the products of sustained-yield indigenous forestry in Westland, where tree crop rotations may run into centuries, compare economically with those of quick-rotation exotic forestry in other parts of New Zealand?

These are some of the formidable problems raised by this bold programme of development and rehabilitation. If the proposals are proceeded with, 1960—the centennial year of the purchase of the region from the natives—will have marked a turning point in the course of West Coast development.—MURRAY MCCASKILL

GATEWAY TO SOUTHLAND. The completion in 1960 of the artificial-island port at Bluff is a reflection of the outstanding progress made by the Southland pastoral industries in the last decade. It will ensure that the further development of the productive potential of the Invercargill hinterland will not be checked by deficiencies of the seaport.

The natural harbour, 14,000 acres in extent, is a tidal lagoon, flanked to the south and west by a peninsula of low volcanic hills. The entrance is a narrow channel 2,000 feet wide and is kept well scoured by the tidal flow. There were three main channels within the harbour and between two of them was a sandbank, just visible at low tide.

By 1952 existing facilities at the port were being severely taxed. The main wharf, a timber structure, was over seventy years old and maintenance was proving very costly. Extensions to the wharves were impossible because of site conditions and, therefore, it was decided to create new berthage on the sandbank between the Ocean-Beach and West Channels.

As a preliminary some 30,000 cubic yards of rock had to be removed along the northern face of the entrance channel to widen it to a minimum width of 350 feet and deepen it to obtain a working draught of thirty-three feet. Then, over a period of two and a half years, the sandbank was built up to form an eighty-four acre island laid out in line with the prevailing winds in a finger-type pier. So that the natural channels of the harbour would not be interfered with, access to the island has been provided by means of a 590-foot road and rail and pedestrian bridge of reinforced concrete. The maximum labour force employed was about 250 men.

Each berth is served by both road and rail, and transit sheds alongside the wharves enable inward cargo to be sorted and despatched direct from the island, thus doing away with the previous practice of hauling all goods to Invercargill by rail before sorting. Because of this new dependence on road as well as rail transport the Invercargill–Bluff highway has been reconstructed and considerably widened.

The island itself—raised sixteen feet above the sandbank—was formed by dredging almost three million cubic yards of sand from the berths and from the new swinging basin. It was retained on the western side by a rubble wall, 7,787 feet long, constructed from some 250,000 tons of rock and clay quarried on Bluff Hill about half a mile away.

The balance of the dredging spoil went to reclaim an area of forty-eight acres along the foreshore where storage tanks for motor spirits and bulk bitumen have been constructed. The whole island reclamation work was in the hands of a French firm.

The fifth berth at the northern end of the island has been equipped to provide all-weather meat loading facilities. As the export of frozen meat is estimated to increase from 60,000 tons in 1959 to 123,000 tons by 1985, a much faster loading rate than at present will be necessary. The frozen meat from the railway waggons will be unloaded from five sidings inside a wharf shed built alongside the wharf apron, and covered conveyors will transfer the meat into the ships' holds. This will allow phenomenal loading rates by comparison with present sling and crane procedures and will speed up the turn-round of ships. The western section of the island has been laid out in eight miles of railway line for marshalling of rail traffic serving the port.

Besides this new port development it is now probable that Bluff Harbour will become the site for a new aluminium smelter utilising hydroelectric power from the Manapouri–Doubtful Sound area and cheap lignite coal from Southland mines, while alumina will be imported from Australia through a deep-water berthage to be built on the eastern side of the harbour near Te Wais Point.

Bluff now ranks third in the dominion by value of exports after Auckland and Wellington. Killings of sheep and lambs at Southland freezing works increased almost threefold between 1939 and 1959, from 1,400,000 to 3,900,000. The tonnage of wool exported from Bluff has increased from 21,000 tons in 1952 to 31,000 tons in 1958. At the same time there have been substantial increases in imports, notably in bulk motor fuels (1952–1953: 4,500 tons; 1958–1959: 45,000 tons). Surveys by the Department of Agriculture, based on recent expansion rates of farm production, forecast that within the next thirty years Bluff will rank first in New Zealand for the volume of its frozen meat and wool exports.—MARION MCFARLANE

AUSTRALIA AT MID-CENTURY: THE ATLAS OF AUSTRALIAN RESOURCES. An outcome of the postwar wave of enthusiasm for the planned and orderly development of Australia was the establishment of the Department of Post-War Reconstruction. One of its tasks was to compile or collect, for departmental use, maps of Australian resources from the great mass of material held by the individual state and federal authorities and scientific institutions.

From this beginning emerged the grandiose concept of the *Atlas of Australian Resources* which, as conceived in 1950, was to be the 'first great and comprehensive atlas of Australia' standing comparison with first class national atlases all over the world. It was to provide reliable information for future national planners, for teachers, politicians, businessmen, scientists and the general public.

With such confused and idealistic objectives, there is little wonder that the final product is rather different in aim and character from the original specifications. Nevertheless, it is a matter for congratulation that the atlas embodying thirty of the fifty maps originally projected, is now completed. (*Atlas of Australian Resources*, Department of National Development, Canberra.) Despite some lapses from perfection, these maps and commentaries form the single greatest accumulation of authoritative and, on the whole, readily assimilable information on contemporary Australia.

The atlas comprises thirty unbound maps, mainly at a scale of 1 : 6 million. It has been published, together with commentaries, in groups of five sheets each year since 1951, with the exception of 1957 and 1959. Most of the maps have been produced by the Department of National Development from material provided by the appropriate federal and state agencies. The exceptions are the specialist maps, 'Vegetation', 'Geology', 'Soils' and 'Climatic Regions', which are contributions by workers in those fields.

The maps fall into four broad categories. Twelve portray aspects of the physical environment; six are concerned with the economic activities of the commonwealth, four with population, and six with the services provided for the inhabitants. Only one map—'Major Developmental Projects'—remains as a reminder of the initial objective of the atlas, and this is in some respects already a historical document, a monument to procrastination and unrealised hopes (for example, the long-neglected Sandy Hollow railway linking the Hunter Valley with the Western Slopes).

Viewed as a whole, the atlas is seen as a vast compilation, painstaking, packed with detail but lacking in any great imagination or originality, at times cartographically mediocre and contributing little in the way of new maps or methods. The challenge of the subject has been to a large extent sidestepped. Although maps of mineral resources are useful how much more valuable would have been maps (initially projected) of such distinctively Australian phenomena as floods, droughts, soil erosion and animal diseases! Ten years of research directed to obtaining such material would have been time well spent, and the result infinitely more valuable than maps of schools and hospitals that are little else but direct reflections of the distribution of population in Australia. Much effort has been expended in developing ingenious systems of symbols to convey an enormous amount of statistical detail, as in 'Manufacturing Industries', 'Mineral Deposits', and 'Mineral Industries'. However, ingenuity to some extent defeats its own purpose because of the difficulty of interpretation. The reader's appreciation of some maps becomes frustrated by the tedium of comparing the magnitude, shape, colour, thickness and shade of outline, degree of infilling and the letters associated with each symbol with those of other symbols and the legend.

The map entitled 'Immigration' uses an ingenious colour shading system to distinguish between similar migrant densities in dense and less densely populated areas, but the effectiveness of this method is to a large extent destroyed by the absence of any regular gradational increase in colour value. Further examples of the unsuccessful use of choropleth colour shading can be seen on the map 'Croplands', where again the colour intensities do not always increase directly with the magnitude of the phenomenon.

Dot distributions are also misused. The map, 'Distribution of Stock' employs on the one map dots of three colours, of the same size, but with different values. Three single-topic maps would have been clearer. 'Croplands' exhibits other less desirable features. Apart from an unfortunate shadow effect associated with all red symbols and the questionable orientation of the cartogram bars along the diverging meridians, there is one major defect—the use of the term 'plantation fruit' as the generic term for pineapples, passion fruit, bananas and pawpaws.

Less important, though equally obvious, are the occasional lapses in colour registry, especially noticeable on 'Underground Waters', the immense range of colour schemes, not all of them pleasing or effective, and the variation of colours used by half-a-dozen printers to portray the ocean background.

The atlas fails to provide adequate information on the metropolitan areas, in which reside and work more than one-half of the population. Although the black and white maps in some commentaries overcome this defect to a certain extent, such important features as the distribution and character of manufacturing, railways and roads, and some of the demographic characteristics are neglected. Some method of indicating the location and concentration of manufacturing within the metropolitan areas could surely have been devised without breaching withholding regulations.

Uniformity in the use of a full continental base map has on occasion prevented the presentation of material to its greatest advantage, particularly where it is of a statistical nature and highly concentrated in location. This occurs, for example, in the component maps of 'Manufacturing Industries' where the greatest part of the sheet is black base map, and the information overly compressed.

The map of vegetation, although a research work of great value, is also a controversial document. It does, however, have the advantage of being undoubtedly the best available at the present time, the first really authoritative map based on wide field research and air photos. Questions as to the value of the classification and the adequacy of the regional division might, however, be raised. 'Dominant Land Use', (more appropriately termed 'Major Agricultural Types') is on the whole rather more acceptable, and is undoubtedly one of the more useful maps in the atlas to geographers generally.

A number of the maps, by virtue of their subject matter and the ingenuity of their presentation, are worthy of warm commendation. The chaotic nature of rail transport in Australia is brought forcibly home by the map of 'Railways', while their importance as primary produce movers is clearly illustrated by freight commodity symbols. Yet, with standardisation proceeding, this, like many other maps in the atlas will soon be a historical document. The presentation of such detailed material on the character and function of ports and the delineation of their hinterlands in 'Ports and Shipping' is also most valuable, although it is possible that some hinterlands would be differently defined if recent trends in road haulage were considered. Of considerable interest also are the two maps of intercensal population changes. Prescott's map of 'Soils' is sufficiently well known not to require comment here.

Each map sheet is accompanied by a printed commentary, some of them containing additional maps, tables, graphs and photographs. On the whole the texts are informative enough although frequently prosaic and uninspiring. Commentaries run the gamut from simple enumeration of points that even the least informed of laymen should be able to read from the map, through technical discourses on Australian palaeontology, to a discussion of the origins, administrative scope and composition of the various levels of Australian government.

Such wide variation in treatment would appear to derive from an insufficiently censorious editing and the duplication that has occurred in the contents of some commentaries should have been avoided. Nevertheless, among the commentaries are one or two that rank as research papers rather than as compilations from secondary sources. Borrie on 'Population Increase and Decrease 1947-54', Zubrzycki on 'Immigration' are outstanding in this respect.

Within any commentary it is often difficult to determine the level at which the author is writing. Statements such as 'wharves can be either along the shoreline or jut out into the water from the shore' or 'coal is compressed vegetable matter' seem too elementary to justify their inclusion in texts of this nature. Although technical terms frequently appear, some of the specialist authors seem to have experienced difficulty in compressing their field without becoming superficial or misleadingly oversimple.

Despite some cartographic and textual errors that reduce the effectiveness of individual maps and commentaries, the atlas as a whole is undoubtedly a work of the greatest value to all professionally concerned with the geography of Australia. Whether it completely fulfils the aims of its initiators or completely satisfies its many and varied users is, however, questionable. (It is hard to see how maps of this scale and degree of detail can satisfy specialists in any field.) To be sure it is the 'first great and comprehensive' atlas of Australia and is superior to any other single source. Considered as a report on the development of commonwealth at mid-century the *Atlas of Australian Resources* is a most commendable production which, with certain additions and improvements, might easily achieve high ranking in the fields of national atlases.

It is to be hoped that the recently announced completion of the atlas is not a statement of finality. The great expansion and development of the commonwealth at the present time is producing rapidly changing demographic, industrial and transport patterns. The rapidity of the change serves only to expedite the transition of some maps from contemporary to historical documents. It is therefore important that as maps become seriously dated—for example, 'Major Developmental Schemes'—they should be revised and reprinted. It is even more desirable that as material becomes available in the future new maps should be added to the series.—M. G. A. Wilson

SECOND PRINTING OF THE DESCRIPTIVE ATLAS: Those responsible for planning and producing the *Descriptive Atlas of New Zealand* (Government Printer, Wellington, 1959,) must have been agreeably surprised, even astounded, when the first printing of 12,000 copies sold out within a week of publication. It is a measure of the popularity of the atlas among New Zealanders that the 20,000 copies of the second printing, made available late in 1960, have nearly sold out within a few months. Such sales figures must be unique in the history of New Zealand publication. No revision has been made of the maps or text in the 1960 printing but the heavier quality paper used has permitted a better colour registration on some maps which appeared rather insipid in the first printing. The improvement is especially marked in the maps of land classification (Nos. 18 and 19) and land utilisation (Nos. 20 and 21), while the physical map (Nos. 6 and 7) has been improved by the stronger tones used for hill shading and for submarine relief. The hill shading on the maps of population (Nos. 16 and 17) has been printed too lightly but it has been strengthened on the manufacturing maps (Nos. 22 and 23) where there is less need for it.

It is doubtful whether there will be a further reprinting or a second edition of the *Descriptive Atlas* but the spectacular sales record should encourage the government to support further cartographic ventures of a more specialised nature. There should be no timidity in proceeding with the publication of the series of detailed historical maps mentioned in the Prime Minister's foreword to the atlas.

THIRD GEOGRAPHY CONFERENCE. The New Zealand Geographical Society's third triennial conference will be held at Palmerston North from August 21st to 25th. The two previous conferences held at Auckland in 1955 and at Christchurch in 1958 attracted wide interest and large membership. Their success augurs well for similar ventures in the future. This year the organisation of the conference is the responsibility of the Wellington Branch of the Society which in turn has delegated much of the work to the small but enthusiastic Manawatu Sub-Branch. An attractive feature of the third conference should be its largely residential character. Accommodation will be provided at Massey Agricultural College and it is expected that the majority of the conference sessions will be held there. Palmerston North is an excellent centre for field excursions into a variety of North Island countrysides and a number of short and full-day field trips are planned. Members of the Society's branches should have received detailed information about the conference from their local secretaries. Any further inquiries should be made to the Conference General Secretary, Mr B. G. R. Saunders, Palmerston North University College, P.O. Box 644, Palmerston North.

PERSONAL. It is with much pleasure that we record the recognition won by two members of the New Zealand Geographical Society in recent awards for distinguished contributions to geographical literature. We are also pleased to record the success of two other members in their appointment to high administrative posts. The Council of the Royal Geographical Society has announced the award of the Murchison Grant to Professor Keith Buchanan of the Victoria University of Wellington in recognition of his contributions to economic geography. The Royal Geographical Society has also announced the award of the Gill Memorial Prize to Dr Cuchlaine King for her contribution to glaciological and coastal studies. Dr King was visiting lecturer in geography at the University of Canterbury in 1956 and is at present on the staff of the University of Nottingham. It is of interest to recall that an earlier recipient of the Gill Prize was Charles Douglas—'Mr Explorer Douglas' of South Westland fame. He received the grant in 1897 in recognition of his 'persistent explorations during twenty-one years of the difficult region of forests and gorges on the western slopes of the New Zealand Alps.'

Dr L. L. Pownall, who succeeded Professor Jobberns in the chair of geography in the University of Canterbury in 1960, has been appointed Vice-Chancellor and Rector in that university. For eight years between 1951 and 1959 Dr Pownall was general secretary of the New Zealand Geographical Society and he has contributed a number of important articles to this journal. It is a matter of particular pleasure that, for the first time in the Commonwealth territories overseas, a practising geographer has been appointed to such high university office. Dr K. W. Thompson, a graduate of the University of Canterbury and at present a Senior Lecturer at Adelaide University, has been appointed to the newly established post of Principal of the Palmerston North University College. Dr Thompson was one of the persons responsible for founding the Institute of Australian Geographers and was its first general secretary.

To these four members go the congratulations and best wishes of the Society.

THESES IN GEOGRAPHY, 1960. Two theses have been accepted by the University of New Zealand for the Ph.D. degree:

The Geography of Power Resources in New Zealand, B. H. Farrell, (University of Auckland);

Historical Geography of Westland Before 1914, M. McCaskill (University of Canterbury).

The following theses have been accepted for masterate degrees during the year 1960:

From the University of Auckland:

The Impact of Forestry and Forest Industries on Kaingaroa–Galatea, M. Chapman;
The Arterial Roadways of Metropolitan Auckland, J. G. S. Myles;
Four Towns of the Waikato: A Problem in the Measurement of Urban Influence, J. S. Whitelaw.

From the Victoria University of Wellington:

The Impact of Dairying on Lowland Taranaki, 1880–1920, Joan M. Burnett;
Rawhitiroa—A Study of a New Zealand Dairy Farming District, B. N. Davis;
The Location of Industry in Greater Wellington, R. W. Sage;
Social Studies in the Primary Schools of New Zealand, J. J. Shallcross.

From the University of Canterbury:

- Rural Settlements of the Canterbury Plains, R. G. Cant;
- Recent Developments in the Mackenzie Country, T. E. Clarke;
- Changing Patterns of Settlement in Tauranga County, Evelyn Dinsdale;
- The Otago Goldfields 1860–1870: Some Geographical Aspects, J. Forrest;
- Two Amuri Landscapes (North Canterbury): A Comparative Analysis, R. J. Scott;
- New Zealand's Coastal Trade, R. G. Shave;
- Masterton, Carterton and Greytown: Their Similarities and Differences in Geographic Character, R. J. Taylor.

Copies of these theses are housed in the libraries of the respective universities.

IN OUR CONTEMPORARIES

In Oversea Journals . . .

LIGHT ON NEW ZEALAND

NEW ZEALAND: David J. de Laubenfels, *Focus*, Vol. 9, No. 1, September 1960, pp. 1-5.

At last New Zealand has had bestowed on it the honour and dignity of being featured in an issue of the American Geographical Society's ten-year-old monthly sheet, *Focus*. Already widely circulated and much appreciated, this journal has devoted almost twenty issues each to Europe, the Americas, Africa and Asia, but this is the first time New Zealand or the Southwest Pacific has been brought into *Focus*. The spotlight has now been switched on to New Zealand by David J. de Laubenfels of the University of Syracuse. His 2250-word essay on the contemporary character and state of the dominion and its economy is in the main a competent review and synopsis. It is supplemented by a series of five small-scale maps depicting Land Use, Landforms, Average Annual Rainfall, Regions, and Towns and Communications.

The body of the essay is devoted to the description of 'eight distinct kinds of landscapes [which] do not correspond exactly to the administrative divisions or the regions into which the country is sometimes divided'. The 'landscapes' are 'the dairy areas', 'the downlands . . . peripheral to the dairy lands', 'the steep hill country', 'low mountains' (which strangely include in the same category the 'Eastern Ranges of the North Island' and 'Westland–Nelson in the South Island'), the 'Volcanic Plateau', 'the alluvial and loessal Canterbury Lowland', 'the high country', and 'the high glaciated Southern Alps'. New Zealanders will find this a confusing classification, especially since the accompanying maps of landforms and 'regions' show no correspondence and provide no assistance in sorting out or interpreting the 'landscapes'. With one or two unexplained variations the map labelled 'regions' does indeed mirror 'the regions into which the country is sometimes divided' although the source of this division is not listed in the seven-item 'brief bibliography' with which the essay is provided.

But these are minor criticisms. More serious criticism may be levelled against the paragraph headed 'Urban–Rural Contrasts'. Many New Zealanders will resent the repetition here of what is almost habitual though not universal American comment on the country. 'The cities. . . . show little vitality [and] have few new buildings. There is little or nothing going on after working hours. . . . city folk apparently go to the country for recreation. . . . Industry is too regulated and protected to encourage initiative. . . . the workers seem content with a fairly easy life and live in suburban cottages' . . . . . . and so on. One has grown weary of subjective and ill-informed comment of this sort from visiting American businessmen and retired and wealthy tourists, but hardly looks for it again in a scientific review of the geography of the country, especially when that review fails to make any reference, for example, to the giant pulp and paper industry, the new scrap-steel industry, the early prospects of oil refining and aluminium smelting, and the unprecedented surge of industrial expansion in the last few years; and more particularly when the article, whilst providing mention of 'top dressing by means of aircraft', of 'the search for better strains of grasses' and of '[geothermal] steam producing some thermoelectric power,' etc., fails to appreciate that the extent and scope of these developments involve some vitality, initiative and progress. To insist that all factories except those processing farm products cater only for home markets, or to claim that Auckland (which has doubled its population since early in the war and has 100,000 more people than Professor de Laubenfels allows) shows little vitality, is not only to betray erroneous impressions, it is also to misstate the plain facts.

To judge New Zealand by exclusively American standards and to compare and contrast it, if only by implication, with a country of continental proportions and industrial maturity is to be neither fair nor objective. And to judge New Zealand in terms of publicity articles and travel brochures is even less scientific. To say the least, it is highly disconcerting for New Zealanders to read that Maoris 'live in villages that have retained much of their ancient character'. Shades of a Hopi pueblo!

—Kenneth B. Cumberland

The Location of Industry

THE CONCENTRATION AND DISPERSION OF MANUFACTURING IN NEW ZEALAND: G. J. R. Linge, *Economic Geography*, Vol. 36, No. 4, October 1960, pp. 326-343.

In this article an attempt is made to give quantitative expression to the manner in which New Zealand's manufacturing is both concentrated and dispersed. The result is somewhat disappointing for although the analysis does serve to re-emphasize some of the distinguishing characteristics of the geography of New Zealand's manufacturing industry, it reveals little that is new.

The analysis is focused initially upon the twenty-five employment districts for which data is obtainable on the number of workers in manufacturing, the salaries and wages paid to factory workers, and the value added by manufacturing. For each of these districts Dr Linge computes an index of the 'magnitude' or quantity of the manufacturing, and also one of the 'intensity' of manufacturing (a measure of the importance of factory industry in the economy of the district). These indices were originally proposed by John H. Thompson of Syracuse University. (See 'A New Method for Measuring Manufacturing', *Annals Assoc. Amer. Geogrs.* Vol. 45, 1955, pp. 416-436.) To obtain the magnitude rating of a district, each of the three variables for the district—the number of workers in manufacturing, the salaries and wages paid to factory workers, and the value added by manufacturing—is divided by the respective dominion averages, and these three ratios are then summed and averaged to give the desired index. Similarly, in computing the intensity rating of a district, the three ratios—the number of workers in manufacturing to total population, the number of workers in manufacturing to total labour force, and the value added by manufacturing to total population—are each divided by the respective New Zealand average and the resulting quotients are then summed and averaged.

As would be expected the overriding importance of the five main population centres as industrial concentrations is borne out by the magnitude ratings. However, it appears likely that had the districts been ranked simply with respect to any one of the three criteria used in computing the magnitude index, a similar ranking would have resulted. The author makes little attempt to justify the use of Thompson's indices other than that they appear to be 'the most useful in the light of the information available in New Zealand'. In this sense however, he is not entirely to blame for Thompson himself did not develop the methodology of his approach to any length. Nevertheless, it is interesting to consider in what sense these multiple criteria indices are meaningful ones and to what extent they depict the distribution and intensity of manufacturing any better than a single criterion index. Studies by H. H. McCarty and his associates, would suggest that the two variables—the number engaged in manufacturing and the value added by manufacturing—are in fact closely related in a statistical sense and may be used almost interchangeably in studies of the distribution of manufacturing.

Having derived the magnitude and intensity ratings for each of the twenty-five districts, Dr Linge proceeds to an interpretation of the distribution of manufacturing. Two basic influences are stressed. The shape and surface configuration of the country is seen as affecting the pattern and cost of communications, while the nature of the historical development of New Zealand from widely-separated early settlements is considered to be critical with respect to the present distribution of population. However, at this point the continuity of the study is broken. No attempt is made to interpret the earlier statistical findings in the light of these so-called 'basic influences'. In fact the latter two-thirds of the article appears to be almost completely divorced from the initial statistical analysis, for it is given over to a discussion of the role of 'material oriented,' 'market oriented,' and 'footloose' industries with only occasional reference to the way in which these industries fit into the general pattern of dispersion and concentration throughout New Zealand. Perhaps this is as well for many of the 'material oriented' industries would certainly prove exceptions to the general rule stated earlier in the paper—that in most cases the activities in an employment district tend to be focused on the one main urban area within the district.

The three categories of manufacturing are by no means mutually exclusive. The agricultural lime industry, for example, could be viewed as being both 'material oriented' and 'market oriented'. Dr Linge is obviously cognizant of this fact but nevertheless he proceeds with a discussion which must necessarily be weakened by its very generality.

Finally, Dr Linge again focuses attention upon locational factors *per se*, particularly as they affect the distribution of the so-called 'footloose' industries. However, his analysis of the role played by the factors of transport, markets, and labour, merely emphasises once again the all too prominent fact that if the five main urban areas are excluded then there is very little manufacturing to be concerned with. Indeed it is this pre-eminence of Auckland, Christchurch, Wellington, Lower Hutt and Dunedin as manufacturing centres, which makes the overall distribution pattern of New Zealand's manufacturing appear to be a relatively simple one. Dr Linge is to be congratulated for his attempt to give greater depth of understanding to the problem of explaining this distribution, but in so far as it attempts to derive general rules the study appears to suffer from its own generality.—LESLIE J. KING

Development of Pastoralism in New Zealand

DIE ENTWICKLUNG DER VIEHWIRTSCHAFT IN NEUSEELAND: Erika Sellenberg, *Erdkunde*, Band 14, Heft 2, June 1960, pp. 115-134.

New Zealand geographers will regret that the published synopsis of Miss Sellenberg's doctoral dissertation at Bonn is so brief and that, in consequence, it has been designed primarily for European readers with little knowledge of the agriculture of New Zealand. The synopsis covers ground with which New Zealand geographers are familiar and deals with the development of the dominion's pastoral economy in a most general fashion—from moa hunters and Maori gardeners to the intensive, technologically-advanced pastoralism of recent years.

Yet this is a careful, detailed and accurate narrative, skilfully elaborated by statistical tables and graphs. Whilst regretting that more of Miss Sellenberg's painstaking library research, her fresh and original interpretations, and her expertly-drafted atlas of new and revealing maps of New Zealand agricultural geography could not have been published, one can but admire the selection of information and the expert compression that have gone into this 9,000-word article. The bibliography of more than eighty items also covers all essential references on the history and geography of New Zealand agriculture and includes five or six references to less well known early statements in the German literature that will be new to New Zealand workers. If it were to be translated, this would constitute the best short and most carefully-balanced historical interpretation available of the geography of pastoralism in New Zealand from its origins to its state of high development at mid-century and just after.

Kenneth B. Cumberland

Weather Systems in the South Pacific

ATMOSPHERIC CIRCULATION OF THE TROPICAL PACIFIC OCEAN: Leslie Curry and R. W. Armstrong, *Geografiska Annaler*, Vol. 41, No. 4, 1959, pp. 245-255.

According to the authors, the object of this study is to provide a genetic description of the weather in the various parts of the tropical South Pacific area, this region being considered as an integrated unit. Their method (again, according to the authors), is to use what data and what ideas are available, and where these are lacking to fill the gap by using the principles of analogy with the northern hemisphere, symmetry about the equator and general consistency of explanation. The result is said to be a regional essay and not a rigorous analysis.

With this latter statement this reviewer is in full accord. Indeed, it is difficult to see how the method proposed can lead to any kind of analysis other than a description of the various theories that have been put forward by other workers and an assessment by the present authors as to their degree of acceptability. And this is substantially what emerges. However, in the assessment process there is a large degree of arbitrariness. Thus, to quote only one example, Estoque's views on the Westerlies–Trades line of convergence in the Indian Ocean are described as 'convincing' while his attempts to extend this zone further to the east are dismissed as 'far-fetched'. Nevertheless no data are presented by the authors to illustrate their thesis or to enable the reader to decide on the relative merits of the two points of view. This method of discussion (which is extensively used), may perhaps be appropriate in a review article or in an expository or didactic work, but detracts greatly from any scientific value the present work may possess.

Again, as stated above, one of the authors' aims is to provide an integrated treatment. Unfortunately, a perusal of the text reveals very little in the way of integration. The discussion is simply summarised in the traditional way under the various regional headings with only an occasional suggestion as to the interconnections between the processes operating in the different regions considered.

The faults mentioned above may be regarded as inherent in the methods used. It is probably significant that as soon as these methods are abandoned and actual climatic data are examined one immediately comes upon interesting material—average rainfall maps for the Pacific Ocean area for January and July. The distribution of average annual rainfall over the central Pacific Ocean (as inferred from data at island stations) has been known for many years to exhibit remarkable features, especially the various dry and wet zones. However, up to the present, the extent to which the average rainfall distribution varies with the seasons has not been investigated and the maps reproduced here represent a useful first step in the study of this question.

Interesting too, are some of the conclusions reached in this study and the authors are surely on the right lines when they suggest that future climatic research should be more concerned with the basic upper-level flow patterns than with the classical low-level concepts such as trade winds and monsoons. In this connection, however, this reviewer would like to add a word of caution—weather is the product of processes occurring in the whole depth of atmosphere and in any explanation of it both surface and upper-level effects are likely to be of equal importance.—J. W. HUTCHINGS

REVIEWS

The Vanishing Wilderness

HERITAGE DESTROYED. THE CRISIS IN SCENERY PRESERVATION IN NEW ZEALAND. By J. T. Salmon. Wellington: A. H. and A. W. Reed, 1960, pp. 100, 8s. 6d.

New Zealand enjoys a world-wide reputation for the beauty of its mountains, rivers and coastlands, and for the unique character as well as the beauty of its native flora and fauna. It also enjoys an enviable reputation as a country of democratic institutions capable of pioneering legislation for the social welfare of its people. It is therefore with an acute sense of shock that the overseas visitor sees widespread before his eyes the results of mismanagement and wanton destruction of the landscape, and learns of the impotence of parliament to effect control over its own appointed ministers, its civil servants, or its private citizens.

Dr Salmon in his timely monograph leaves us in no doubt as to where he places the blame for most of the destruction that he attacks with convincing fervour—the ministers and bureaucrats who direct the New Zealand Electricity Department and the Ministry of Works. The greater part of his attack is directed specifically at the schemes for developing power at Aratiatia Rapids and in the thermal area, and the proposals to use Lakes Manapouri and Te Anau to generate electricity for aluminium smelting. The results of past developments for power at Lakes Waikaremoana, Tekapo, Pukaki and particularly Monowai are stressed, partly for the value they have in illustrating what may be expected if the Manapouri–Te Anau scheme goes through and the levels of the lakes are raised. The Desert Road and the Arthur's Pass road are cited as scenic routes disfigured unnecessarily by the careless positioning of pylons and poles.

There is a useful summary of the achievements of conservation authorities in other countries, particularly the United States and Great Britain, and Dr Salmon makes an urgent plea for establishment in New Zealand of a body akin to the Nature Conservancy of Britain. Perhaps still more urgent is the reform of legislation to permit greater parliamentary control over schemes initiated by government departments or ministers which conflict with the aims and principles of national parks and scenic reserves.

Dr Salmon's concern is with the destruction that is proceeding now and heralded for the future, not with what has been achieved in limited fields of conservation. This reviewer feels, however, that the objective of the book, to stimulate concern and positive action, would have been helped by more examples of constructive work of preservation, demonstrating forcibly that much can be done at modest expense. Furthermore, it is no less than justice to recognise such achievements as the establishment of parks and reserves and the appointment of boards of qualified people to administer them. These boards may still be much handicapped by the limitation of their powers but their existence has enabled much to be done to preserve natural conditions and make them accessible to the public.

The results of dam construction on related aspects of the environment, such as the height of the water table above and below the barrage, are considered and Dr Salmon rightly stresses the need for investigation into such possibilities. But it is doubtful if the cause of conservation is served by such a sweeping and unsupported statement as: 'Heavy rainfalls of catastrophic proportions become more common and the beneficial drizzling rains that normally extend over several days occur less frequently.'

Similarly, Dr Salmon would be better advised to avoid economic considerations than to pursue an argument like that on page 61 where he compares the earning capacity of a 90,000 kW station at Aratiatia (calculated at £88,452 per year) with the revenue received in one year from all overseas tourists in the whole of New Zealand, even if 'nearly all of them went to see Aratiatia.' In any case it is doubtful if overseas tourists will omit Aratiatia even if a power station has become master of the rapids. The case for conservation in no way depends on the number of tourists who are attracted to scenery in its wild state, and invalid economic arguments merely lend fuel to the enemies of conservation.

Well selected photographs, many of them taken by Dr Salmon illustrate the consequences of raising the levels of lakes, of ill-sited power lines, erosion of high country accelerated by burning and over grazing, and the depredations in forest land of noxious animals and indiscriminate milling, as well as some of the renowned scenes that have been recently destroyed or are currently threatened.

Dr Salmon has performed a valuable task in producing this little book, and the publishers are to be commended for making it available at a modest price. If there is, by some chance, any reader of this journal who is not sympathetic to conservation it is the more necessary that he should read *Heritage Destroyed* so that he may realise at least some of the misdeeds that are being condoned by the community at large in the name of economic development.—LESLIE SYMONS

PIONEERING IN THE CANTERBURY HIGH COUNTRY

SAMUEL BUTLER AT MESOPOTAMIA. By P. B. Maling. Wellington: Government Printer in conjunction with the National Historic Places Trust, 1960, pp. 67, 7s. 6d.

The year 1960 marked the centennial of Butler's arrival in Canterbury and his establishment as a runholder at Forest Creek in the upper reaches of the Rangitata River. He stayed in Canterbury for only four and a half years (during which time he increased his capital from £4,400 to £8,000) and later wrote that he had found the life at his sheep station 'utterly uncongenial'. Yet it helped to inspire his famous book *Erewhon* and it is because of the literary fame he acquired in later years and the association of the Mesopotamia sheep station with *Erewhon* that he is given a conspicuous place in the early history of Canterbury. As Dr Maling says, 'It was fortunate for posterity that Samuel Butler stepped ashore at Lyttelton at the time that he did, for *Erewhon* is an important book in literature which might not otherwise have been written'; and he adds later, 'Butler has touched the Mesopotamia scene with immortality.'

To the student of geography, the whole of this book is fascinating. It gives a most vivid picture of the establishment and building up of a back-country sheep run from its beginning, but the most intriguing part of it is the publication, for the first time as he wrote it, of Butler's 'Forest Creek Manuscript'. This was found, together with two sketches by Butler, between the leaves of a book purchased by a young man in 1935 in the Caledonian Market, London, and was acquired by the Canterbury Museum in 1954. From this manuscript, which Butler wrote in his hut at Forest Creek in June 1860, the reader can relive the pioneering of the Canterbury pastoral country—the exploration for 'new country', the discomforts of the initial sod or cob or V hut, the dangers of flooded rivers, the isolation, the trips to Christchurch for supplies and human company, the stocking of the run and the subsequent efforts needed to prevent neighbouring flocks getting mixed, the burning off of the tussock, speargrass and wild Irishman, and the 'joys' of camping out. Butler's description of the indigenous vegetation and bird life is evidence of his careful observation, and of great interest is his mention of 'the tender grasses that spring up between and underneath the tussocks', supporting Lady Barker's observation that the tussock 'serves as shelter for a delicious undergrowth of short, sweet herbage.'

It was a happy thought to entrust the necessary historical research for this publication to Peter B. Maling, a member of the Canterbury Regional Committee of the National Historic Places Trust. Dr Maling's ability and painstaking work in searching out the necessary detail is evidenced again in this book as it was previously in his editing of *The Torlesse Papers*; that earlier work has been described as a model of editing and this present publication reaches a similar standard. He has made of the material available as lasting a memorial to Butler's short stay in Canterbury as the plaque unveiled recently at the site of Butler's first hut at Forest Creek, and at the same time has placed on record what is probably the most authoritative description of Canterbury's back country prior to its alteration by introduced plants and animals.

—J. L. Hewland

Secondary Industry in the New Zealand Economy

INDUSTRIAL DEVELOPMENT CONFERENCE JUNE 1960: BACKGROUND PAPERS. Wellington: Government Printer, 1960.

This publication is important for two reasons. In the first place, the fact that an industrial development conference was organised at all indicates that a reassessment is taking place about the part that secondary industry has to play in the New Zealand economy. In the opening address to the conference, which was held in Wellington during June 1960, Mr Walter Nash told the assembly that 'it is only recently that we—as a nation—have begun to look at New Zealand's industrial development with new eyes. Until now, we have tended to take our future development for granted'. This is perfectly true; the 'she's right' attitude that is such a characteristic of the New Zealand way of life is also a feature of the economic policies adopted by successive governments since the second World War.

It is impossible to know whether the series of decisions and suggestions arising from the conference, or even the tenor of the papers and discussions, will in fact have much influence on government policies, more especially as the control of the dominion's affairs passed so soon afterwards from Labour to National hands. However, it would be a very unwise cabinet that did not give this publication very careful scrutiny.

In the second place, the papers are a valuable addition to the literature on New Zealand manufacturing and economic development generally. No less than forty-one background papers were prepared covering such diverse subjects as town planning, investment, tourism and vocational training. Before picking up this volume the reader has to be prepared to separate a good deal of chaff from the wheat. As might be expected the authors of some of the papers have taken this opportunity to ride pet hobby horses so that the contents are tinged with a political hue or are flavoured with the views of sectional interests in the community. In other words not all the papers are completely objective.

Most of these statements were prepared by persons well qualified to write in their fields. But for a few authors this seems to have been their first essay into their subject; this in itself would not be a bad way of turning up new ideas, but at least these writers should have taken the trouble to read the existing material and then commented or enlarged upon it. The brevity of this note makes it invidious to mention specific papers, but there is a marked contrast between those in which the author obviously knows his subject and has given his paper a good deal of thought, and those that read like jottings done the night before.

One can conclude that these papers together form a worthwhile document indicating the thoughts of a wide range of people at a particular point in the development of New Zealand. However, while some are concise and erudite statements that stimulate the mind, others are pretty thin and add little to the fields they purport to cover. Although a sign of the times, this volume does not form an industrial charter for New Zealand, but it may give some direction to the considerable amount of research and thought that is still required.—G. J. R. Linge

Australasia and Neighbourhood

AUSTRALIA, NEW ZEALAND AND THE SOUTH WEST PACIFIC. By K. W. Robinson. London: University of London Press, 1960, pp. 340, 31s.

In a public examination held in New Zealand shortly after the last war candidates were asked to name the textbook they had used during the year and any other books on the subject that they had consulted. Although this question has never been repeated most of us would agree that teachers and their senior pupils or students should read as widely as possible and consult several authorities rather than merely accept and reproduce the statements and opinions expressed by any single author. For this reason the appearance of another text on the Southwest Pacific is most welcome. The author, a former New Zealander and graduate of the University of Canterbury, is now a senior lecturer in geography at Newcastle University College, New South Wales. His book is based on personal experience gained through many years of lecturing, field work and travel in both New Zealand and Australia.

The book is in three parts. The first six chapters are devoted to a systematic study of the area—Diversity and Unity, Structure and Physiography, Climate, Vegetation, Soils and Animal Life, Native Peoples, and finally, the Resource Basis of Land Use, Industrialisation and Population Distribution. Part Two is a regional study. One chapter deals with the Pacific Islands and two further chapters with New Zealand. In the remaining chapters the author divides Australia into nine regions.

The third part of the book deals with certain aspects of political geography. One chapter points to the characteristics of each of the Australian states. The second deals with the Australian federal system, its scope, limitations and problems. The third is entitled 'Geography and Government in New Zealand'. In the final chapter the Pacific Islands are grouped according to their particular form of government, for example, constitutional monarchy (Tonga), protectorate (British Solomon Islands), territories, trusteeships, colonies and condominiums. It concludes with sections on the South Pacific Commission and the role played by Australia and New Zealand in the area.

The Australian sections provide a wealth of information and should prove invaluable to New Zealand students and teachers. These chapters would be even more valuable if there were adequate maps of the regions. The two maps of Southeastern Australia are a little confusing with their multiplicity of lines showing regional, subregional and state divisions. In fact as one reads these chapters and continually searches for the map that is not there, one realises how fundamental is the need for a good location map in the geography textbook.

The New Zealand section is rather disappointing. One has the feeling that it is some years since the author had any direct personal contact with his homeland, and that although the book was published in 1960, it ignores many changes that have taken place in recent years. For example, one learns that a coal-fired power station is under construction near Mercer; limonite licks are used for cattle in the Volcanic Plateau; the halting of the Maori exodus to the towns is among the numerous requirements for progress; communications in Northland are frequently primitive and incomplete. (Even fifth form School Certificate candidates of several years ago were warned to avoid a statement such as this last one.) A map of power stations on the Waikato River is several years out of date. The map of New Zealand showing its division into regions is very crudely drawn in comparison with other maps in the book. Both the shape of the country and the location of some of the urban centres are obviously inaccurate.

Despite these shortcomings the book should prove to be a most valuable one for New Zealand students. With its greater emphasis on Australia it should prove to be an ideal companion volume to K. B. Cumberland's earlier *Southwest Pacific.*

—C. M. Herbert

Land and People in the Pacific World

SOCIAL STUDIES IN GEOGRAPHY. 1: THE PACIFIC WORLD. By G. Jobberns and J. A. Ross. Christchurch: Whitcombe and Tombs Ltd., 1960, pp. 226, 15s 6d.

The Thomas Report of 1944 made some recommendations on the content of the new core subjects, social studies, but left much to the discretion of its teachers. After unhappily trying to integrate history and geography, most schools produced workable schemes, although the lack of suitable textbooks has always been a problem.

This new book is the first of two intended to deal with social studies in geography for the third and fourth forms of the secondary schools of New Zealand. In the foreword to *The Pacific World* Dr Jobberns writes: 'This book is not a regional geography. It is an account of some aspects of land and people in the Pacific World. Different kinds of country give their people different opportunities, and this is why some background knowledge of geography is necessary to understand human society. Some knowledge too, of how societies have grown through the ages is essential.'

Chapter 1 is a timely introduction to the problem of world population. Chapter 2 gives a synoptic view of the Pacific World and then the next ten chapters give historical and geographical information about the countries bordering the Pacific. The final chapter 'Prospect of a New Age' deals with the South Pacific Commission, the Colombo Plan and international co-operation in the Antarctic.

A great amount of information has been packed into this book. The historical notes are concise and relevant, though some teachers will probably supplement these to suit their own syllabus requirements. The geography is first class, comprehensive, up-to-date and probably not too difficult for 'the average third-form pupil' mentioned in the foreword. The style is direct and compact. It is possibly hypercritical to doubt if one very common sentence construction (two statements separated by a semi-colon) is a good model for third formers, many of whom do not know when they have completed a sentence. Clear and helpful maps and diagrams cover aspects of both history and geography but there is a minor error in the climatic graph of Manila (p. 93). The illustrations have been skilfully selected and excellently reproduced and it is indeed refreshing to see so many new photographs. The publishers too, are to be congratulated on their part in this production. An attractive cover in colour, good-quality paper, sharp reproduction of illustrations and a bold type face generously spaced help to place this book in the same class as the best of the attractive overseas textbooks.

Most teachers will agree that it is very difficult to judge the merit of any textbook until it has been used with a class for at least one year. Apart from this cautious reservation, there seem to be no reasons for doubting that this book will be both popular and useful in the postprimary schools.—R. G. Wilson

A New Survey of England

NORTH ENGLAND. By A. E. Smailes. London and Edinburgh: Thomas Nelson and Sons, 1960, pp. 324, 50s.

The dearth of any up-to-date regional study of the British Isles has long been all too apparent to teachers and students of geography. No one volume dealing specifically with the regions of the country has appeared since Ogilvie's *Great Britain: Essays in Regional Geography*, (last revised in 1937) and valuable though it is, it can hardly be regarded as up-to-date. The new series on the regions of the British Isles, of which *North England* is the first to appear, therefore may be expected to fill in a considerable gap in library resources. It is with these considerations in mind that Professor Smailes's book must be assessed, as well as on its own individual merit.

The study is organised on classic and well-tried geographical lines, commencing with a reasonably detailed account of the physical background. This is succeeded by a section on the human occupation of the area, beginning with the prehistoric and Roman settlement, and tracing the growth of settlement, agriculture and urban centres up to the present. In doing so Professor Smailes admirably demonstrates the profound influence that both physical setting and historical factors have on present day geography. The last part of the book is concerned with the description of the subregions into which North England can be divided.

Professor Smailes has written a very useful and eminently readable account of an important part of England. A northcountryman himself, he succeeds in giving the reader a realistic picture and an understanding of the landscape in its widest sense. In this he is aided by an adequate number of black and white maps and diagrams, all of which are to the point, and most of which are clear and attractive. The inclusion of a folded, layer-coloured topographical map, which can be spread out and readily consulted as the book is read, is also a commendable feature. Further illustration is provided by thirty-six well chosen half tones, including reproductions of old maps and prints not generally accessible. These latter are of particular value, but it is regrettable that in a book which must be regarded as a rather expensive production, the plates are grouped together at the end, and not inserted at appropriate points in the text.

In many respects, this book can be thoroughly recommended to those engaged in a detailed study of the geography of the British Isles, or who will appreciate a good, readable account of a part of the country in which they may have a particular interest. The price, however, seems likely to reduce its appeal to a good many students for whom it could provide a most useful supplement to the currently available textbooks. A similar price for the whole series of the volumes may well reduce its practical value.—JANE M. SOONS

CROSSROADS OF THE WORLD

ATLAS OF THE ARAB WORLD AND THE MIDDLE EAST. Introduction by C. F. Beckingham. London: Macmillan and Co. Ltd., 1960, 35s.

Of recent years it has become a practice to publish atlases on significant areas of the world, the Oxford series being notable in this respect. This atlas, however, comes from publishers who have not figured prominently in the cartographic field, but who consider that such a series of maps is needed to assist the studies of many specialists. In this premise they are correct, for although much has been written about the Arab World, and probably even more about the Middle East, few authors have fortified their arguments and enhanced their descriptions by adequate and accurate maps.

The forty pages of maps and data provided in this atlas go far to meet the deficiencies hitherto apparent. Geographers will perhaps deplore the garish colours used to depict relief, and will certainly cavil at the use on economic maps, of the symbols that are 'proportional to importance of production' with no criteria given as to what the importance is in the first place. One interesting speculation is why the Arab village in the maps showing types of settlement is not named when all other places are. Was it necessary to construct a composite picture, and if it was, is that not falsifying reality? On the other hand, more seriously, confusion is apparent in the maps depicting agriculture—or as it is sometimes named—land use. Terminology is far from exact in these maps, and the definition of agricultural regions, so called, is often arbitrary.

The textual section of the atlas embraces twenty pages, and includes forty-two photographs which depict something of the distinctive character of lands which have figured so prominently in the past, and in which history contributes so much to the geography. Professor Beckingham's commentary is concerned mainly with the spread of Islam and the rise and fall of empires, and concludes by emphasising the belief among Arab leaders that only in the mastery of modern technology can economic independence be achieved—as long as Arab and Islamic tradition is not repudiated.

For those who know the Middle East, whether they possess the knowledge and discernment of a Ronald Storrs, or are just interested, as many an exserviceman will be, this atlas will be most useful or vastly illuminating as the case may be.

—JAMES W. FOX

CLIMATIC ANOMALIES

THE EARTH'S PROBLEM CLIMATES. By Glenn T. Trewartha. Madison: University of Wisconsin Press, 1961, pp. 334, $7.50.

This is a book which will be welcomed by all students and teachers of climatology. The author is well known for his previous work in this field and in the present volume he has set himself the problem of investigating the anomalous climatic patterns of the world. Only an experienced person familiar with the most recent research programmes could have undertaken such a task. The result is a book which presents much stimulating material for the climatologist. It is not, however, one that can be used at an elementary stage. Trewartha assumes the reader has a background knowledge of world climatic patterns and classification systems.

A world map of Köppen's modified climatic classification forms the starting point for the book. The familiar diagrams showing the distribution of precipitation on a hypothetical continent are also presented, and these together form the standards by which anomalous patterns are recognised.

The author not only describes the climates of the areas regarded as anomalous, but has also attempted to account for their presence in terms of genesis. His approach is therefore dynamic. A treatment of climate as a simple statistical abstraction gives the geographer little idea of the reality of weather and its constant variations. Trewartha recognises this problem by trying to explain the varying forces at work to produce such anomalies. The book is divided into six parts, each covering an area of continental size: Latin America, Australia–New Zealand–Equatorial Pacific, Africa, Southern and Eastern Asia, Europe and the Mediterranean Borderlands and Anglo-America.

For the climatologist the discussions on the problem climates of the earth should stimulate both thought and further research, especially in those areas where a satisfactory explanation cannot be given without more detailed study and observation. The section on southern and eastern Asia, for instance, presents the most up-to-date account of research results. During the last few years the traditional explanation of the monsoonal system has been challenged. Here for the first time is a synthesis of the latest evidence available. The dry western littorals, particularly that of South America, is a further subject to which the author devotes much time. Although many of the queries on the causes of problem climates remain unanswered the reader is given much food for thought.

One or two deficiencies may be noted. The treatment of Australia–New Zealand–Equatorial Pacific is somewhat disappointing. This is no doubt a reflection of the lack of published research and observations over what is mainly a water surface. In the discussion of the Caribbean little mention is made of the influence of easterly waves and the formation of hurricanes. Both these elements should feature quite prominently in any dynamic approach to the climate of that area.

A section of notes at the end of the book provides comments on source material, and there is a comprehensive bibliography which in itself is a valuable feature since many of the articles noted are in widely scattered sources. Altogether the book provides much interest and should be a valuable and essential addition to the climatological section of a geographer's library.—J. S. WHITELAW

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